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FCC Tries to Derail H.R. 73

The FCC has told Congress that it does not want H.R. 73 to become the law of the land. H.R. 73 is the so-called "Amateur Radio Spectrum Protection" bill and it would force the FCC to replace any bands taken from amateur radio with comparable spectrum. According to Derk Forrester, a legislative assistant to Congressman Jim Cooper, the Commission wants Congress to keep hands off: "The only opposition that we have heard about has been from the Federal Communications Commission itself. They wrote us a letter saying that, in their opinion, we should just trust them because they can do a fine job of managing spectrum without our advice."

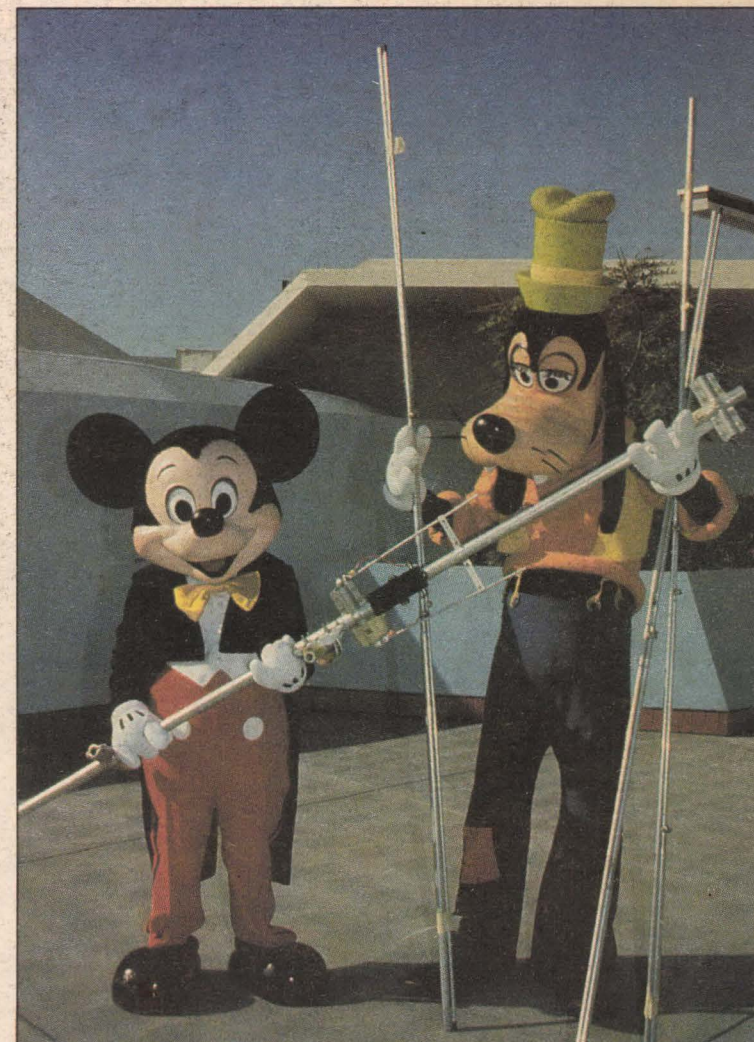
Forrester said that regardless of the position that the FCC may have, it is still an agency that is totally subservient to Congressional oversight and is not a policy-making body: "That was the kind of response we would have expected from the FCC because they do not like to be tied down in any way. They like to be able to do whatever they want to do, but it is the responsibility of Congress to set telecommunications policy and that is all H.R. 73 is. It sets a policy that there ought to be a reserve of spectrum—kind of like a public park—to ensure that amateurs and students especially have a place to learn radio skills and to experiment and to serve the public in times of crisis. So we very strongly believe that H.R. 73 will be a contribution to

federal communications law and regardless of what the FCC says, we intend to push forward and gain its passage."

Representative Cooper introduced the House version of the bill. According to Forrester, his boss is not paying much attention to the FCC. On the contrary, Representative Cooper is plowing ahead to get even more Congressional support for this ham radio cause: "We want to mention our thanks to all of the amateurs who have written and called their legislators because—and again I want to stress this—while it has been a real education job that we have had to do (on Congress), getting 160 co-sponsors on a piece of communications legislation is practically unheard of here. All of the hams who have contributed to the knowledge base of members of Congress who have signed onto the bill should give themselves a pat on the back for doing a good job and making sure that the members are up to speed on the substance of this issue, and that they are doing the right thing by signing their names on the dotted line to give us support."

Forrester advised the amateur community to continue to pressure legislators on this issue, with special efforts to be made to several key players: "I would advise ham operators to keep in touch with Congressmen Carlos Moorhead, Don Ritter, Jack Fields, Mike Oxley, Michael

Continued on page 4



Two members of the Disney ARC, getting the antennas ready for the Special Event weekend.

Disney Amateur Radio Clubs to Celebrate Opening of Euro Disney Resort With Special Event Station

In commemoration of the April opening of the spectacular Euro Disney Resort, located just outside of Paris, France, the Disney Amateur Radio Clubs will operate their third international "special event station" on April 4 and 5, 1992.

In addition, the four Disney clubs, which are located at Disneyland in Anaheim, California (N6MM), Walt Disney World in Orlando, Florida (WA4ABQ), Tokyo Disneyland (JL1YZB) and the Queen Mary & Spruce Goose Entertainment Center in Long Beach, California (W6RO), will be joined by the Radio Club de St. Maur (FF6KMX) in Paris, France.

Stations will be operating SSB on 14.250, 21.325 and 28.450, plus or minus. Operating hours for the commemorative special event station will be from 0000 on April 4 to 2400 on April 5.

This is the third special event organized by the Disney radio clubs. During the inaugural event, in honor of Disneyland's 35th anniversary in 1990, more than 2,000 contacts were made with other radio operators. In September 1991, the first international special event station, which commemorated Walt Disney World's 20th anniversary, resulted in 6,800 contacts from operators all over the world.

Stations contacting one of the Disney Special Event stations should send their S.A.S.E. and QSL with QSO number to: Disneyland Amateur Radio Club, Box 3232, Anaheim CA 92803.

(Editor's Note: Yes, we know this is the second time we've put a photo of Mickey Mouse on our cover. Why? ... Because we like him!)



**Space shuttle Atlantis prepares to fly.
Work the ham astronauts. See story on page 18.**

Photo by Sean Sullivan KC4YES.

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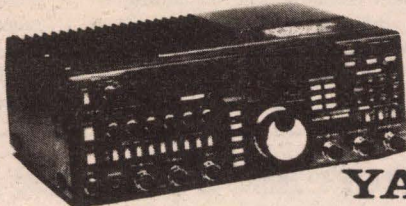
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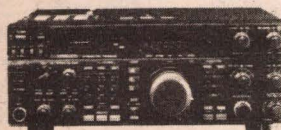
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Novice and Technician Test Question Pool Revision

The VEC's Question Pool Committee (QPC) is asking for public input on the Novice (Test Element 2) and Technician (Element 3A) questions. The revision schedule calls for the public to submit their suggestions for new and revised test questions to the QPC between February 1 and June 30, 1992.

On July 1, 1992, the QPC will begin their deliberation on revision of these two question pools, which are the sole requirement for the Codeless Technician operator license. The QPC plans to release the new questions, multiple choices and answers to the public at year end. New study material is scheduled to be available from the various publishers on May 1, 1993. The new questions will begin turning up in VEC exami-

nations on July 1, 1993.

Now is your chance to let your feelings be known! Present copies of the Novice and Technician questions are available to persons wishing to participate in the revision process from the W5YI-VEC for \$2—which includes postage. Your Suggestions should be sent to the following QPC members: Ray Adams N4BAQ, WCARS-VEC, 5833 Clinton Hwy. #203, Knoxville TN 37912-2545, (615) 688-7771; Fred Maia W5YI, W5YI-VEC, P.O. Box 565101, Dallas TX 75356, (817) 461-6443; and Bart Jahnke KB5NM, ARRL-VEC, 225 Main St., Newington CT 06111, (203) 666-1541. *TNX W5YI Report, Vol. 14, Issue #2, January 15, 1992.*

FCC Continued from page 1

Bilirakus, Stan Schaffer, Joe Barton and Norman Lent. All of those are key players on telecommunications matters, and this is the type of an issue that I believe we will need to have strong Republican support for, although we are doing terrific on the Democratic side. And, we are doing well with Republicans who are not on the committee, but getting those folks (Republicans on the telecommunications sub-committee) on board would help". *TNX Westlink Report #617.*

Tech Class Now Most Popular Way Into Amateur Radio

The amateur licensing figures for the end of September 1991, the end of the federal fiscal year, released by the FCC indicate that the Technician class license is becoming the most commonly chosen route into the amateur radio hobby.

In the 12 months beginning with October 1990 there were 38,363 new amateur licenses issued and 30,825 upgrades.

Scholarships for Radio Amateurs

The Foundation for Amateur Radio, Inc., a non-profit organization with headquarters in Washington, D.C., plans to administer 45 scholarships for the 1992 - 1993 academic year, to assist licensed radio amateurs. The Foundation, composed of 50 local area amateur radio clubs, fully funds five of these scholarships with the income from grants and its annual hamfest. The remaining 40 are administered by the Foundation without cost to the various donors.

Licensed radio amateurs may compete for these awards if they plan

to pursue a full-time course of studies beyond high school and are enrolled in or have been accepted for enrollment at an accredited university, college or technical school. The awards range from \$500 to \$2,000, with preference given in some cases to residents of specified geographical areas or the pursuit of certain study programs. Clubs are encouraged to announce these opportunities at their meetings, on their nets, during training classes, and in their club newsletters.

For additional information and an application form, send a letter or

QSL card, postmarked before May 31, 1992, to: FAR Scholarships, 6903 Rhode Island Avenue, College Park MD 20740.

The Foundation for Amateur Radio, incorporated in the District of Columbia, is an exempt organization under Section 501(c)(3) of the Internal Revenue Code of 1954. It is devoted exclusively to promoting the interests of amateur radio and those scientific, literary and educational pursuits that advance the purpose of the amateur radio service.

Increased Novice Repeater Privileges Petition

Dr. Michael C. Trahos KP4PGC of Alexandria, Virginia, filed a *Petition for Rule Making* with the FCC on December 31, 1991, requesting that Novice class licensees be authorized repeater and repeater control operator privileges.

Docket 86-161, the so-called Novice Enhancement proceeding of 1987, increased Novice voice privileges on the 10, 1.25 and 23cm bands. Not included, however, were Novice operating privileges on the 222 MHz repeater output frequencies. On November 12, 1991, the ARRL asked the FCC to expand Novice class operator privileges to the entire 222 - 225 MHz band. "... the Commission should consider combining this Petition and [ARRL's] RM-7868 into a

single *Notice of Proposed Rule Making*."

Trahos contends, "... the League's petition preserves the prohibition of Novices from being repeater licensees and control operators for no apparent good cause." He argues that licensees in the Private Land Mobile (business) Radio Services (PLMRS): (1) Have no minimum age requirement (although minimum age is 18 for General Mobile Radio Service); (2) are not required to take a written, technical examination; (3) need not be further licensed to repair or maintain their equipment.

He further argues that "... Novices are currently eligible and are repeater licensees, control operators and trustees in the PLMRS and GMRS." He believes it is absurd to limit Novice amateur repeater privileges when there is no parallel restriction in the commercial services.

Trahos believes that only two restrictions on Novice repeater operation are valid. The FCC should limit Novices to using commercially manufactured repeater transmitters

and the present reduced power levels should remain in force "... for biological safety concerns." (25 watts PEP at 222 - 225 MHz and 5 watts at 1270 - 1295 MHz.) He contends, "It would also serve as an incentive for Novices who wish to construct their own homemade repeaters to upgrade their license."

Also submitted were the Trahos comments to the FCC on ARRL's RM-7868. He supports the League's petition and says it is difficult to understand why the Commission would allow Novices to utilize repeater output spectrum at 23cm (1270 - 1295 MHz band) but not at 1.25 meters.

The generally accepted band plan for 222 - 225 MHz allocates 222.34 - 223.38 to repeater inputs paired with 223.94 - 224.98 outputs. Present rules prohibit Novices from operation above 223.91 MHz. The input/output 23cm band plan calls for 1270 - 1276 repeater inputs and 1282 - 1288 outputs. Trahos questions the logic of allowing Novices to operate simplex at 1282 - 1288 MHz, but not at 223.94 - 224.98. *TNX W5YI Report, Vol. 14, Issue #2, January 15, 1992.*

ARRL Submits Proposal for Changes to Business Rule

On January 6, 1992, the American Radio Relay League presented the FCC with a 14-page letter that proposes to modify Section 97.113, "Prohibited Transmissions." The FCC may or may not offer the letter for public comment; the agency has not yet decided how to treat it.

Under the League's proposal, amateurs could conduct communications for themselves or for others that could "reasonably be furnished alternatively" through other radio services—such as cellular telephone, business radio or government services—as long as they do not do so "on a regular basis." Retransmission of NOAA Weather Radio and WWV-

WWVH propagation broadcasts—or at least the "information" within the government stations' signals—would be allowed "only occasionally" and (the periods of "only occasionally" and "on a regular basis" were not defined).

Amateurs would be able to "notify" each other about ham equipment for sale, but not on a regular basis. Schoolteachers could be paid for operating an amateur station as a part of their classroom instruction.

The changes are presented mainly in terms of how amateurs could better provide communications for such public service activities as Boy Scouts and parades. "An ancil-

Young Hams Needed as Speakers

Radio Fun columnist Carole Perry WB2MGP is looking for youngsters with a good working knowledge of amateur radio and an ability in public speaking to join her at the 1992 Dayton Hamvention Youth Forum. Contact Carole at Media Mentors, Inc., P.O. Box 131646, Richmond NY 10313-0006; or phone her at (718) 983-1416.

lary goal was to avoid the administrative difficulty of detailed situational interpretations of the rule that plague both amateurs and Commission administrative staff," the ARRL said. "[W]ith respect to the content of transmissions, amateur-to-amateur communications should be permit-

ted unless specifically prohibited; and ... in general, unless amateur communications are done for compensation, or for the pecuniary benefit of the amateur or his or her employer, they are permissible," it said. *TNX W5YI Report, Vol. 14, Issue #2, January 15, 1992.*



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Radio Fun

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(603) 525-4201

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RADIO FUN (ISSN 1055-887X) is published monthly by Radio Fun, a division of Out To Launch Communications, Inc., Forest Rd., Hancock, NH 03449. Subscriptions: \$14.00 per year. Canada add \$8.00. Foreign add \$12.00 surface/\$32.00 airmail. Second class postage pending at Hancock, NH and additional mailing offices.

POSTMASTER: Send address corrections to RADIO FUN, P.O. Box 4926, Manchester, NH 03108.

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Mark Forbes KC9C, Rocklin CA Recently, a packet message circulated from a new ham in Florida. He had received his no-code Technician license and had subsequently bought an HF rig. When someone mentioned to him on a local repeater that he didn't have HF privileges, he checked the *FCC Rule Book*, and was shocked. I was too! How could he NOT know that he didn't have HF privileges?

Well, without much looking, I discovered the answer is shocking, but simple. The simple reason is that the Novice and Technician question pools have not been updated to reflect the no-code rule change (nor the Novice 80m band relocation either). Anyone studying from the question pool (as most prospective hams do) finds questions such as:

"What are the HF privileges authorized to a Technician control operator?" (answer, according to the question pool: "3700-3750 kHz, 7100 to 7150 kHz . . .") Not only is this the wrong answer for no-code Techs, it's wrong for Novices and code-qualified Technicians because the 80m band was relocated!

How could someone who downloaded those questions from the ARRL bulletin board or CompuServe have any inkling that they don't have privileges for which questions exist? Now, most (why not all?) VECs have eliminated those questions from tests, according to Bart Jahnke at the ARRL. But that doesn't solve the problem . . . it doesn't even address the problem.

I received a letter from Bart Jahnke manager of the ARRL Question Pool Committee (QPC), responding to my challenge to tell me what was being done.

Bart said that the "QPC . . . is addressing the [Novice and Technician] pools simultaneously in order to bring them up-to-date over a reasonable—published—period." He also included a copy of the schedule published in the September 1991 issue of *QST*. This schedule is paraphrased here:

QPC to begin work on syllabi:

10/1/91

Call for public input:

2/1/92 - 6/30/92

QPC to begin work on pools:

7/1/92

Implementation of new pools:

7/1/93

In other words: 1) Prospective hams will be studying from outdated questions for another year and a half! 2) It will take *two-and-one-half YEARS* for the QPC to respond to the no-code rule change! 3) It will take the QPC more than twice the time that the FCC needed to write the NPRM, solicit public input, solicit response, and implement the new rule!

This schedule is ludicrous. There is something seriously wrong with the current system if a sweeping rule change like the no-code Technician (or even less sweeping, like relocating an entire Novice band) takes years to get into the question pool.

The QPC and VECs must wake up and deal with reality. First, many

letters

potential (and upgrading) hams do indeed study solely from the question pool. Whether the QPC wants to believe it or not, the vast majority of people studying for ham exams memorize the question pool; they do not *learn* the material. For most, the question pool is exactly "the complete compendium of knowledge." To ignore this any longer is negligent.

Because of that, the question pools *must* be constantly kept up-to-date. Bart says, "... question pools are not updated overnight—in fact, the input of the entire amateur community is solicited each time a pool is updated." This clearly points out that the system *doesn't work!* Is the input of the "entire amateur community" really necessary? I don't think so. Why, then, is the system set up to allow five months for this input? And, why can't the question pool be "edited" to correct questions when a rule change occurs? It's not necessary to update the entire pool.

So, come on VECs and QPC: the current system doesn't and cannot work. Rules change much too frequently for the question pools to be updated every two (or more!) years. . . . The current schedule for complete pool updating is fine . . . but there must be a mechanism to keep the questions current. It's hard to believe, but it's very possible that a new Novice licensee in June 1993 will be unaware that the Novice band was changed in the fall of 1991; or that a no-code Technician examinee that same month a year-and-a-half from now will be certain that he (or she) has HF privileges since the Official Question Pool says so.

The VE program is one of the best things ever to happen to amateur radio. The work of the volunteers is exemplary. But, unless the method of revising the question pools is changed to reflect the real-world needs, all of the question pools will soon become uselessly out of date. VECs: Please don't let that happen!

(Editor's Note: Due to its extreme length, Mr. Forbes' letter has been extensively edited. We hope we have presented his main points the way he intended.)

Ken Sluder, Webelos Den Leader, Cub Scout Pack 405, Powder Springs GA I was delighted to pass by the local newsstand and see a photo of my Webelos Scout Patrol looking back at me from your front cover!

As Webelos Den Leader with Cub Scout Pack 405, I can say that these Scouts were overjoyed to participate in the 1991 Jamboree On The Air. Since this is an annual event, we look forward to setting up our Special Event Station again in the spring and will try to speak with you from the Bert Adams Scout Reservation. We are grateful for the expert assistance from the Metro Atlanta Amateur Radio Society. **RF**

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They come with a lightweight retractable cord that eliminates the dangling cord problem. They feature excellent audio on both transmit and receive. MFJ-284 for Icom or Yaesu; MFJ-286 for Kenwood.

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Solving the UTC Mystery

Do you know what time it really is?

by Ken Gledhill N7TXG

Despite the fact that the FCC has rescinded the law which required all amateur radio operators to keep an accurate log of their QSOs, many of us take pride in continuing this longstanding practice. Besides the usual station call sign, location, and frequency information, most logbook entries also include a record of the date and time of each QSO. When a time is entered either in your station logbook or on a QSL card, it should be recorded in Universal Coordinated Time (UTC) rather than local time. This article is mainly aimed at helping new hams to understand the idea behind UTC, and to learn how to convert local time into UTC. As an added feature, in the latter part of this article I describe how you can modify a simple electric clock to display UTC directly, eliminating the mental gymnastics required to convert local time to UTC.

The Need for Universal Time

It wasn't until the advent of long-range communications that there was even a need for individuals in different locations around the world to coordinate time. Before then, very little thought had been given to how to record the time of an event that could be simultaneously observed at two distant locations. However, in the early part of this century, scientists in Greenwich, England, recognized the growing need for a universal time standard. As a result, they developed a world time standard which, for the most part, remains in place today.

Actually, the idea behind universally reckoned time is rather simple. The Greenwich scientists divided the world into 24 time zones by drawing 24 equally spaced imaginary lines extending from pole to pole. The local time in each time zone

is offset by one hour from the local time in the immediately adjacent zones. The staggering of local time between zones is such that the sun rises at approximately 6:00 a.m. and sets at approximately 6:00 p.m. in all zones around the globe. Because of this staggering, the sun rises at nearly the same time of day (local time) on the East Coast of the U.S.A. as it does on the West Coast. This situation would not exist if there weren't three hours difference between the local clocks at these two locations.

The International Date Line

Since the Greenwich people thought of the idea, it is only fitting that the universal time standard is set to their local time. Thus, in England UTC and local time are the same. As one travels east from Greenwich, the local time is advanced one hour each

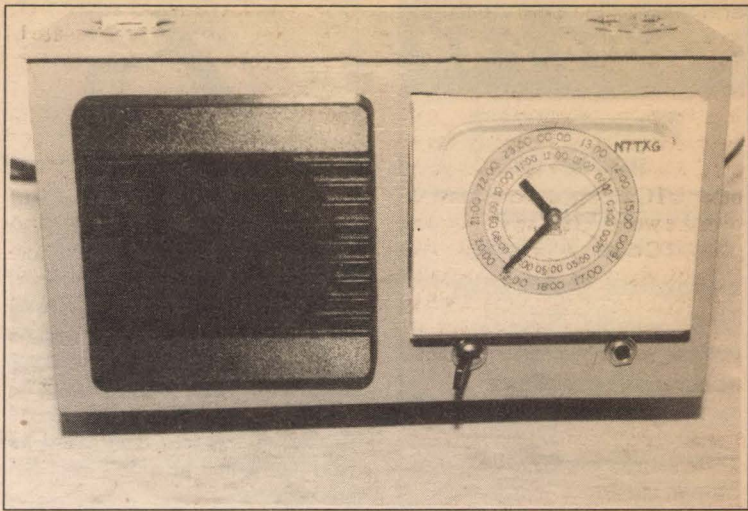


Photo A. The completed station UTC clock.

time a new time zone is entered; and correspondingly, the local time is delayed one hour in each time zone located farther west of Greenwich.

One doesn't have to be a rocket scientist to figure out that, since the earth is more or less round, and if time is advanced going around the earth to the east, and delayed going to the west, about half way around the earth from Greenwich there will be a disparity of nearly one entire day. Indeed, such a disparity does exist. To rationalize this large difference in time on the opposite side of the earth from England, the Greenwich people established what is called the International Date Line. This is an arbitrary line running from the North Pole, through the Pacific Ocean, to the South Pole. As is true of all adjacent time zones, in the zone immediately to the east of the International Date Line the local time is only an hour earlier than the local time in the zone immediately to the west of the line. However, the date on the east side of the line is one whole day behind the date on the west side of the line.

As an example of how the International Date Line works, consider the city of Apia, Western Samoa, located in the Pacific Ocean in the time zone immediately east of the

International Date Line. When the local time there is 08:00 on January 19th, the local time is 07:00 on January 20th on Wallis Island, which is located only 200 miles to the west of Apia in the adjacent time zone, but west of the International Date Line. A similar situation exists far to the north where Nome, Alaska, is only 150 miles east of Uelen in what used to be the U.S.S.R., but the local time in Nome is only one hour less than a full day behind the local time in Uelen.

Universal Coordinated Time

Although these locations may be far from your particular QTH, you are still affected by this means of reckoning time established in Greenwich decades ago. The standard that has been adopted universally, applying worldwide, is to record time as if we were all in the same time zone—the Greenwich time zone. Time recorded in this manner is referred to as Universal Coordinated Time—abbreviated "UTC," after the French form of the name.

On the UTC standard, when it's 05:32 UTC on July 7th in Madagascar, it is also 05:32 UTC on July 7th in Fargo, North Dakota... and everywhere else in the world, too. UTC is not affected by daylight savings time shifts, so your station clock, which is set to UTC, should not be changed when your state changes back and forth between daylight savings time and standard time.

Universal Coordinated Time is kept on a 24-hour basis, and is not switched between a.m. and p.m. every 12 hours as local time is. The date is rolled over at midnight. (Midnight is recorded either as 24:00 UTC on the previous day, or as 00:00 UTC on the following day.) Noon is 12:00 UTC, and times in the afternoon continue counting in sequence up to 23:59 UTC—just before midnight. For example, in Greenwich, when the local time is what we commonly refer to as 3:20 p.m., it is 15:20 UTC.

Setting Your Clock to UTC

To set up a station clock which shows UTC, it is only necessary to have a clock which displays time in a 24-hour format set with the appropriate offset between your local time and UTC. The proper time offset for your particular location corresponds to the number of time zones between your QTH and Greenwich, England. The information shown in Table 1 is useful in determining the proper off-

Table 1. Shading the Clock Rings

Time Zone	Ring	Dark Hours	Light Hours
EASTERN, U.S.A.	inner	12:00 to 11:00	11:00 to 12:00
	outer	23:00 to 00:00	00:00 to 23:00
CENTRAL, U.S.A.	inner	12:00 to 12:00	none
	outer	none	00:00 to 00:00
MOUNTAIN, U.S.A.	inner	01:00 to 12:00	12:00 to 01:00
	outer	00:00 to 13:00	13:00 to 00:00
PACIFIC, U.S.A.	inner	02:00 to 12:00	12:00 to 02:00
	outer	00:00 to 14:00	14:00 to 00:00
HAWAII & ALASKA	inner	04:00 to 12:00	12:00 to 04:00
	outer	00:00 to 16:00	16:00 to 00:00
JAPAN	inner	12:00 to 03:00	03:00 to 12:00
	outer	15:00 to 00:00	00:00 to 15:00
GREENWICH, ENGLAND	inner	12:00 to 06:00	06:00 to 12:00
	outer	18:00 to 00:00	00:00 to 18:00

Dark and light colored areas run clockwise between the times listed.

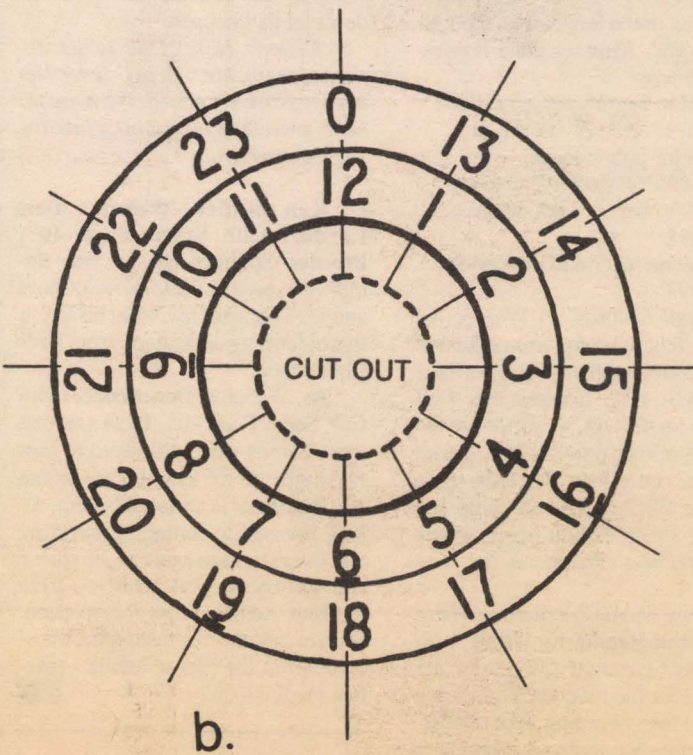
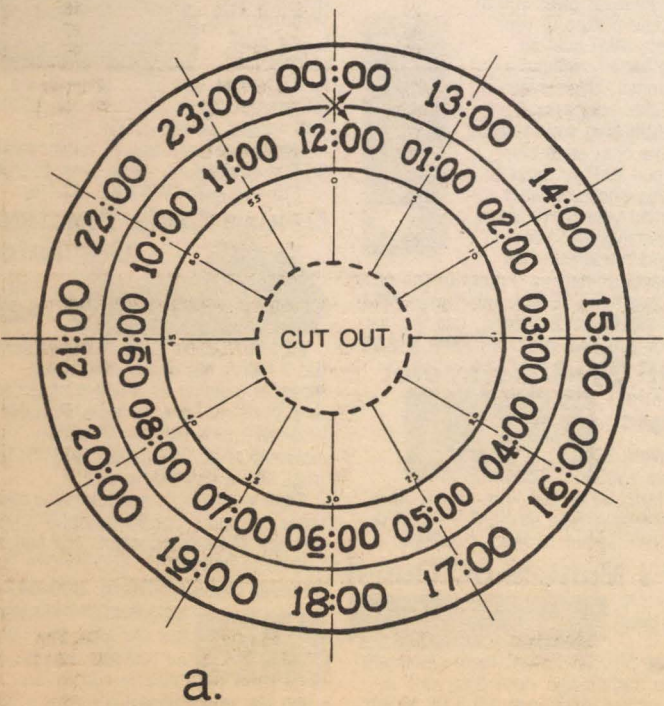


Figure 1. Two sample artworks for modifying a standard clock to display time in a 24-hour format. You can photocopy and use one of these figures, or design your own.

set for several locations around the world. (You should use the offsets in Table 1 only when your local time happens to be daylight savings time.) It is instructional to note that, with your station clock properly set to UTC, it will show the same time as all other UTC clocks in hamshacks all over the world. Thus, when you read your UTC clock and record into your logbook the time that a particular QSO took place, your contact will be logging the same UTC time into his logbook, regardless of the difference in your respective QTHs.

One possible area where confusion may arise is in calculating which way the offset is to be made. To help clear up this issue, the following example is given. Suppose that you live in California, and that your local time is Pacific Standard Time (PST). From the data in Table 2, you'll find that since you are eight zones west of Greenwich, your local time is 8 hours behind UTC. To make up the eight-hour deficit, you must set your station's UTC clock ahead by exactly eight hours. (Realize that QSOs held during the evening hours in the U.S.A. will actually be recorded in the logbook using UTC as early hours of the next day.) Continuing with our example, a QSO involving your California station that takes place at 9:30 p.m. PST on March 10th will be logged in your book as 05:30 UTC on March 11th.

To understand how to calculate the proper time shift between local time and UTC, let's go through the previous example by steps: (1) Local time is first converted to the 24-hour system. So, in this case, 9:30 p.m. becomes (9+12):30, or 21:30. (2) Next, since PST is eight hours behind UTC, eight more hours must be added, giving (21+8):30 or 29:30. (3) Finally, noting that there are only 24 hours in a day, we realize that we have passed midnight and that we must record the date as the next day. That means that we must also subtract 24 from the calculated time. Accordingly, we get (29 - 24):30, or 05:30 UTC on the following day, March 11th.

Before leaving the topic of UTC, it is worth noting that time in UTC is often abbreviated with the letter Z, which means "time in zone Z," or Greenwich time. Thus, the notations 13:43 UTC and 13:43 Z are equivalent in amateur work.

Building Your Own UTC Clock

To have your own UTC clock, you will need to have a clock that displays time in 24-hour format. A number of ham radio equipment suppliers advertise in *Radio Fun* and other magazines who offer such clocks for as little as \$10. However, for those of us who insist that ham radio be fun, I will tell you how to make your own UTC clock out of a simple electric clock for just pennies.

To be sure that the following idea was workable, I bought three different clocks from a local second-hand store for \$2 each. Many of you will already have a similar clock in your goodie trove, saving even the \$2. The only real requirement is that your clock's clear plastic face cover must be removable to allow access to the hands and the surface behind them. Most clocks are designed with a clear plastic cover that can be easily re-

moved with a flat-blade screwdriver. The cover is usually held in place by a couple of snap-in tabs that fit into the frame around the clock face. I found that very little force was required to remove these covers, so I advise you to not get too rough and crack the plastic.

With the plastic cover removed from the face of your clock, you are ready to generate the artwork for the new face of your clock. You can

obtain the artwork simply by photocopying Figure 1a or 1b, or you can draw your own design on a sheet of plain white paper with a ruler, protractor, and compass. A stencil may come in handy, too. At this point, you need not be concerned about the difference in size between your clock and the artwork. If you draw your own artwork, start with an original that is approximately 7" in diameter. The large size will allow you to work

much more accurately and comfortably than is possible on a smaller scale.

By examining the artwork in Figure 1, you will see that in both cases there are two concentric rings or scales: one corresponding to the familiar 1 o'clock through 12 o'clock local time, and another that runs from 13 o'clock through 23 o'clock with 0 o'clock printed directly above the 12 o'clock point. The artwork in Figure

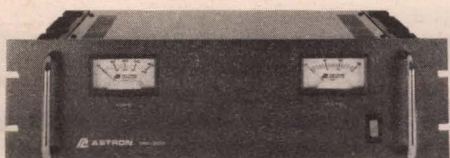
1a shows the hours as 01:00, 02:00, 03:00 . . . on up to 23:00; but, if you prefer, you can simply use 1, 2, 3 . . . on up through 23. (The artwork in Figure 1a is more readable on small clocks.)

A Trip to Your Photocopy Machine

The artwork is easily reduced or enlarged to the proper size by using a



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SL SERIES 	<table><thead><tr><th>MODEL</th><th>Colors Gray Black</th><th>Continuous Duty (Amps)</th><th>ICS* (Amps)</th><th>Size (IN) H x W x D</th><th>Shipping Wt. (lbs.)</th></tr></thead><tbody><tr><td>SL-11A</td><td>• •</td><td>7</td><td>11</td><td>2 3/4 x 7 5/8 x 9 3/4</td><td>11</td></tr></tbody></table>		MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)	SL-11A	• •	7	11	2 3/4 x 7 5/8 x 9 3/4	11	• LOW PROFILE POWER SUPPLY																																																														
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*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

photocopy machine with this capability. Measure your clock face to decide the final diameter that is best for your particular clock. By making successive reductions and/or enlargements, you should end up with one that matches your measured need. Once you get a copy that is the right size, make a few extra copies while you're at it, just in case you mess one up. If your original was somewhat larger than the final version, you will be pleased at the sharpness of the final product.

Shading the Artwork

You will notice from the photographs that I shaded portions of the scale in two different colors. The darker (blue) section of the scale represents the night hours, where the lighter (yellow) sections represent the daylight hours. The areas of shading depend upon the time zone in which you reside. You should color the lighter portion of the scale beginning with the UTC time corresponding to 6:00 a.m. local time and extend it thorough 6:00 p.m. local time. The darker shade will run from the UTC time corresponding to local 6:00 p.m. for 12 hours forward to 6:00 a.m. local time.

To illustrate, my native state of Arizona is on Mountain Standard Time (MST), so we are seven hours behind UTC. Photo B shows how I shaded the artwork to begin the light color at seven hours earlier than 06:00 UTC, or 23:00 UTC. The light color



Photo B. Coloring the design to highlight the scale to be read. This artwork is for the Mountain time zone. Other coloring schemes are given in Table.

extends forward for 12 hours, but at 24:00 the time switches to 00:00. So the light scale runs from 23:00 to 00:00 on the outer scale, and then from 00:00 on the inner scale to 11:00. The local dark hours run from 11:00 to 12:00 UTC on the inner scale, and then continue from 12:00 on the outer scale to 23:00. This coloring of the scales serves as an excellent memory aid when reading the clock. In the daylight you use the hour numbers on the light-colored portion of the scale, and in the night you read the hour from the dark-colored portion.

You should shade your clock artwork to correspond to the time zone in which you live, but the numbers will remain fixed, as I have shown

in the figures accompanying this article. To help each of you know what portions to shade for your specific time zone, see the data in Table 1. Of course, at different times of the year, there will be more or less light outside, but that will not affect the usefulness of the shading as a mental crutch.

The Final Touches

With the artwork complete, all you have to do is cut it out and cement it over the face of the old clock. (Before you cut out the clock face, you may add your callsign in one corner for a custom look to your station clock.) The artwork should fit

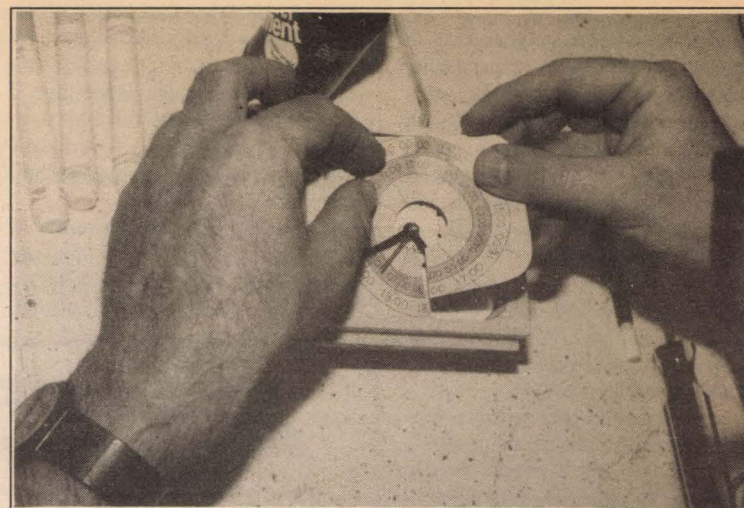


Photo C. Dry-fitting the design to the clock face ensures a good fit.

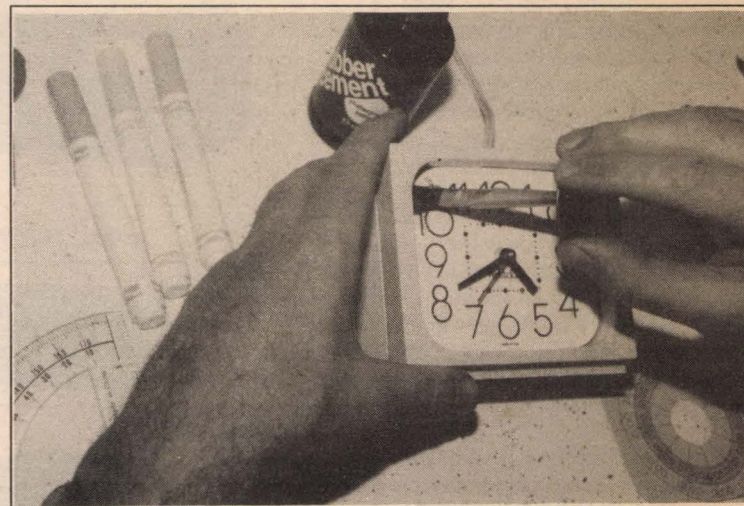


Photo D. Use rubber cement to attach the design over the old clock face.

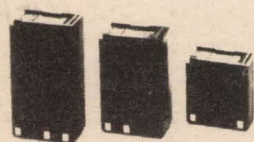
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BP82, BP83	
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BP85A 9.6v 600 mah 3"	\$69.00
BP85B 12v 600 mah 3"	\$69.00

KENWOOD



PB1 12v 1000 mah	\$59.00
KNB4 7.2v 2200 mah	\$59.00
PB6 7.2v 750 mah	\$46.00
PB7 7.2v 1500 mah	\$55.00
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MT500 15v 500 mah	\$39.00

RADIUS

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SABER

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PB 14 12V @ 800MAH	

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12N 12v 700 mah	\$47.00

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FNB4A 12v 1000 mah 4"	\$55.00*
FNB3A 9.6v 1200 mah 4"	\$45.00

*BASE CHARGE ONLY

YAESU

FNB-2 v 500 mah	
FNB-2 v 600 mah	
FNB-4A 12V 1000mah	\$55.00
FNB-17 7.2V 600mah	\$30.00
FNB-10S 7.2v 1000 mah	\$42.00

FNB-12S 12v 600 mah	\$45.00
290 charger	\$65.00
(For FNB 17,10S, 12S)	

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Side, top or base charge with 8AA Sanyo 600 NiCads	\$25.00

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FNB-2 10.8V 600 mah	\$19.00
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SANYO

AA 600 mah	\$ 1.35
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SANTEC 142, 144	
STANDARD BP-1	
TEMPO S-1, 2, 4, 5, BP-15, S-15	
TEN TEC 2991, 2591	
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DISCOVER

the entire face of the clock. You will need to make a single cut up from the periphery to allow the new face to slip around the hands. (See Photo C.) It will take you a few tries to get the face trimmed to fit flat against the old face. Once you are satisfied that the face is correct, all that remains is to spread rubber cement on the old clock face and position the new face with the 00:00 and 12:00 straight up. and

let the cement dry. (See Photo D.)

Before replacing the clear plastic cover, you may wish to cut off the alarm hand, as I did. It can be confusing, and I couldn't think of any use for it. With the clear plastic cover replaced, all that remains to be done is to set your completed clock to UTC, as described.

Here at my Arizona QTH, right now it is 3:37 p.m. local time. How-

ever, checking my completed UTC clock (Photo A), we can see that it's really 22:37 UTC! **RF**

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Table 2. Offsets for Standard Time Zones

Location	Offset from UTC	Local Time = 12:00 UTC
Nome, Alaska (see text)	11 hrs. behind	1:00 AM = 12:00 UTC
Apia, W. Samoa (see text)	11 hrs. behind	1:00 AM = 12:00 UTC
Honolulu, Hawaii	10 hrs. behind	2:00 AM = 12:00 UTC
Anchorage, Alaska	10 hrs. behind	2:00 AM = 12:00 UTC
San Francisco, CA (PST)	8 hrs. behind	4:00 AM = 12:00 UTC
Salt Lake City, UT (MST)	7 hrs. behind	5:00 AM = 12:00 UTC
Chicago, IL (CST)	6 hrs. behind	6:00 AM = 12:00 UTC
New York City, NY (EST)	5 hrs. behind	7:00 AM = 12:00 UTC
Buenos Aires, Argentina	3 hrs. behind	9:00 AM = 12:00 UTC
Greenwich, England	0 — no offset	12:00 NOON = 12:00 UTC
Paris, France	1 hr. ahead	1:00 PM = 12:00 UTC
Jerusalem, Israel	2 hrs. ahead	2:00 PM = 12:00 UTC
Cape Town, S. Africa	2 hrs. ahead	2:00 PM = 12:00 UTC
Delhi, India	5-1/2 hrs. ahead	5:30 PM = 12:00 UTC
Tokyo, Japan	9 hrs. ahead	9:00 PM = 12:00 UTC
Sydney, Australia	10 hrs. ahead	10:00 PM = 12:00 UTC
Wallis Island (see text)	12 hrs. ahead	12:00 MIDNIGHT = 12:00 UTC
Uelen, U.S.S.R. (see text)	12 hrs. ahead	12:00 MIDNIGHT = 12:00 UTC

Offsets for Selected US Cities on Daylight Time

Location	Offset from UTC	Local Daylight Time = 12:00 UTC
San Francisco, CA (PDT)	7 hrs. behind	5:00 AM = 12:00 UTC
Salt Lake City, UT (MDT)	6 hrs. behind	6:00 AM = 12:00 UTC
Chicago, IL (CDT)	5 hrs. behind	7:00 AM = 12:00 UTC
New York City, NY (EDT)	4 hrs. behind	8:00 AM = 12:00 UTC

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TH-77A	2M/70CM DEL DUAL B	599.95	CALL

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TM-331A	220MHZ 25W PROG MIC	469.95	CALL
TM-441A	440MHZ 25W PROG MIC	479.95	CALL
TM-631A	2M/220MHZ DUAL BAND	749.95	LMTD CALL
TM-791A	2M/70CM/7 TRIBANDER	849.95	CALL
TM-741A	2M/70CM/7 TRIBANDER	849.95	CALL
TM-941	2M/440M/1.2 TRI-BAN	1199.95	CALL
TM-751A	2M 25W ALL-MODE	699.95	CALL
TM-711A	2M 25W ALL-MODE BASE	1059.95	CALL
TS-790A	2M/70CM SATELLITE	1999.95	CALL

HF EQUIPMENT

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IC-2SRA	2M/SCANNER HT	599.00	CALL
IC-24AT	2M/70CM DEL MICRO	499.95	CALL
IC-3SAT	220M 2-5W MICRO	449.00	CALL
IC-4SAT	70CM 2-5W MICRO	449.00	CALL
IC-4SRA	70CM/SCANNER HT	599.00	CALL
IC-4GAT	70CM 7W 15MEM DTMF	449.00	CALL
IC-W2A	2M/70CM DUAL MICRO	629.00	CALL

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IC-229H	2M FM, 45W 20MEM	479.00	CALL
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IC-3220H	2M/70CM 45W 40MEM	699.00	CALL
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IC-735	HF DELUXE COMPACT	1149.00	CALL
IC-751A	HF 12V BASE TXCR	1699.00	CALL
IC-765	HF DELUXE TNR,PS	3149.00	CALL
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FT-690RII	6M 10W ALL-MODE	752.00	CALL
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FT-5200	2M/70CM DUAL BAND	749.00	CALL
FT-6200	70CM/1.2 DUAL BAND	899.00	CALL
FT-2400H	2M 50W,LCD,CTCSS	419.00	CALL

HF EQUIPMENT

MODEL	DESCRIPTION	LIST	OURS
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FT-757GXII	HF COMP GEN COV	1089.00	CALL
FT-767GX	HF 21/220/70C TUNR	2299.00	CALL
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CIRCLE 162 ON READER SERVICE CARD

Discovery Place Ham Station

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by Tom Bradbury NU4G

How do you make ham radio visible, especially to young people?

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That's what the Mecklenburg Amateur Radio Society in Charlotte, North Carolina, teamed up to do with Discovery Place, the city's uptown science museum. Now the W4BFB Amateur Radio Education Center is part of the museum's new \$14 million Michael J. Smith Wing, which opened last fall. It was named for the North Carolina astronaut killed in the explosion of the space shuttle *Challenger*.

The station sits behind sliding glass doors between the museum cafeteria and the gift shop, just down the hall from the Omnimax entrance. Visitors waiting in line for the show or lunch can watch a hams-in-space video. Or they can step in to have volunteer hams demonstrate the hobby with a packet station, an all-mode 2 meter rig and an HF setup complete with a beam atop a 60-foot tower mounted on the roof of the five-story museum addition. There's even an SWL corner where they can tune the shortwave broadcast bands.

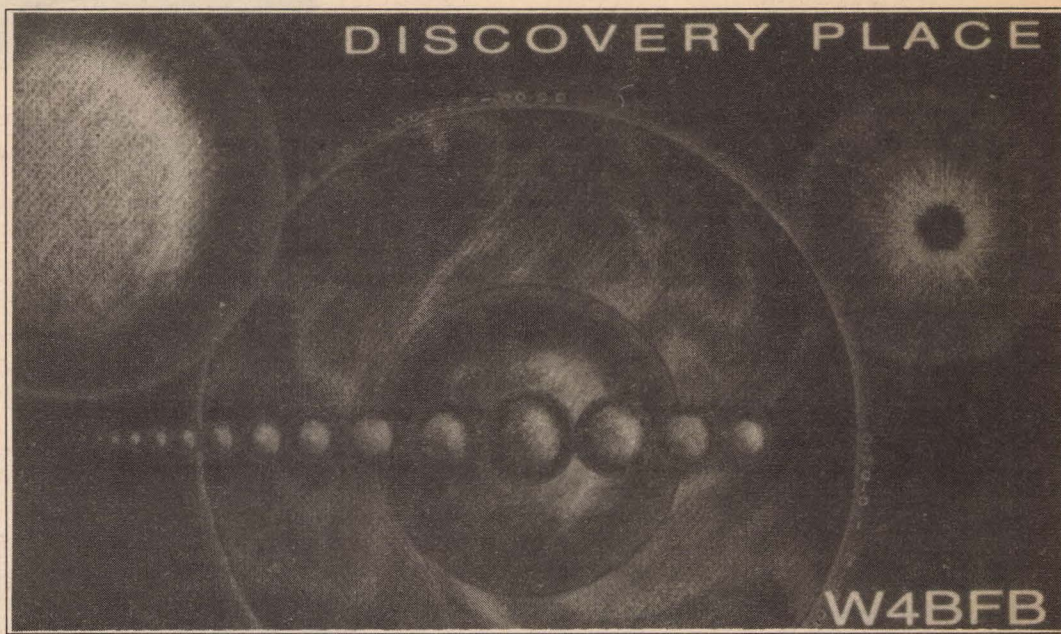
For a decade, Discovery Place has been a premier science education

facility in the region, drawing more than 100,000 school children each year for formal programs, plus thousands more who come with their families to enjoy the museum's wide range of demonstrations and try-it-yourself science exhibits. With the opening of the new planetarium and theater, attendance is projected to grow substantially, passing half a million this year.

Most will see the ham station. Ervin Jackson N4BIG dreamed of such a station more than a decade ago, when he was on the original board of Discovery Place. The opportunity came with the construction of the new wing.

With the support of the museum administration, the hams were able to work closely with the building architects. The tower base, for example, is part of the roof, and conduit carries feedlines and control cables straight to the station. A \$25,000 donation from United Carolina Band provided underwriting for the room itself, and Jackson set out to raise the station's \$30,000 initial equipment budget. The success is attested to by the names of more than 20 Founding Donors above the door, by the permanently mounted QSLs of hams giving \$100 inside, and by the long wall of furnishings and equipment, including:

- A TV/VCR to show ham videos to passersby, even when the station itself is not open.



- A 2 meter packet station with an ICOM IC-229H, Kantronics controller and a video display to pique the interest of computer-minded visitors.

- A 2 meter all-mode station using an ICOM IC-275H to an 11-element beam.

- A rack-mounted Ten-Tec Omni V transceiver with a Hercules II amplifier and a Ten-Tec automatic antenna coupler. Wire antennas cover the low bands. For 20-10 meters, a five-band Mosley Pro-57 sits atop a 60-foot tower on the roof.

- A try-it-yourself SWL corner with a receiver and code-practice oscillators.

- Other equipment, including a pair of handhelds and pieces of early gear, and a spark gap "transceiver" used to carry weather news during the flood that swept the Carolinas in 1916.

- Wall displays such as world and U.S. maps, local and UTC time indicators, an ARRL flag, and a great circle map and beam indicator centered on Charlotte.

There are ham radio comic books visiting students can take with them, forms for getting more information,

and a sign-up sheet for the club's ham classes. The room is designed so people can watch through the doors, wander in to peek at what interests them, or pull up chairs for small classes.

Most of all, it is designed to let people experience ham radio. Station manager Bob Southworth KI4YV is a retired electrical engineer with a gift for patient explanation, whether to a scout group learning about communications, or to casual visitors strolling by. He and other volunteers can show what the different modes can accomplish, and get visitors pulled up to the microphone to try rag-chewing themselves. Visiting hams are encouraged to operate (bring your *original* license) and to become station volunteers. Jackson stresses that the station is not a closed operation of the Mecklenburg society but, like the museum, dependent on a much wider area. Indeed, support has come from as far away as Jordan, whose King Hussein Ibn Talal JY1 is a founding donor.

Tucked up against the city's new skyscrapers, Discovery Place is about as public a location as there could be

for ham radio in the Charlotte region. As part of the festivities for the opening of the new wing last November, the station got a look from thousands of visitors taking advantage of the free Omnimax previews, as well as visits from Richard Vinroot, Charlotte's new mayor, and Terry Sanford, one of North Carolina's U.S. senators. The local paper featured Mecklenburg Amateur Radio Society President Ralph Eubanks KK4FC and member Dave Lewis K1CBB in a color picture accompanying a story about the new station.

All that was just introduction. The station's real visibility will come as 10,000 or more people visit the museum each week. Most will pass by and look in. Many will go through the open doors and accept the invitation of the volunteer hams on duty to see what the hobby is about, and how they can become a part of it.

For information on operating hours for Discovery Place and the W4BFB Amateur Radio Education Center, write to: Discovery Place, 301 N. Tryon Street, Charlotte NC 28202, or call (704)372-6261. **RF**



Photo A. One of the opening day visitors to the station was U.S. Sen. Terry Sanford, shown here at the main HF station with visiting ham Patricia Hensley N4ROS a South Carolina school principal and ARRL educational adviser for the Roanoke Division.

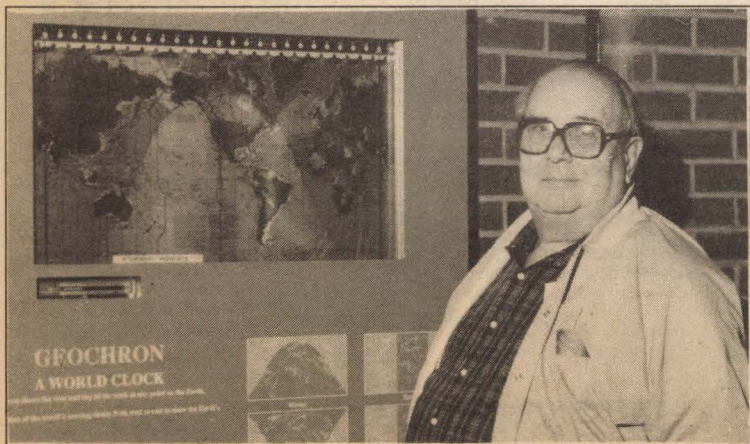


Photo B. Visitors to the Discovery Place science museum can see the grayline phenomenon not only on the wall, but in action in the W4BFB Amateur Radio Education Center. Shown here is station manager Bob Southworth KI4YV.



Photo C. Want to show your support for the W4BFB Amateur Radio Education Center in the Discovery Place science museum? For a tax-deductible donation of \$100, you can have your QSL card permanently mounted on the wall.

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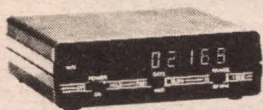
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CT-70	20 Hz–550 MHz	<50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	\$139.95
CT-90	10 Hz–600 MHz	<10 mV to 150 MHz <150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	\$169.95
CT-125	10 Hz–1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	\$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	<25 mV to 50 MHz <10 mV to 1 GHz <50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	\$239.95
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New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-b coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. Kit includes delivery. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

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Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC. PR-2, wired, includes AC adapter \$59.95

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TR-1, RF sensed T-R relay kit \$8.95

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FM-3WT, as above, but fully wired and tested \$19.95
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A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC. Complete kit MD-3 \$16.95

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Commodore C64/128 packet radio interface. Uses famous German Digicom software. Features EXAR IC chip set for reliable operation—runs HF or VHF tones. Includes FREE disk software. PC board, all necessary parts and full documentation. Complete kit, PC-1 \$49.95

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•223 MHz
•440 MHz



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AA-7 Kit \$24.95
Matching case & knob set, CAA \$12.95

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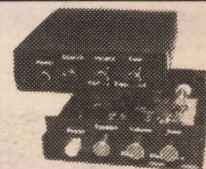
Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit \$29.95
Matching case & knob set, CSS \$12.95

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Shortwave receiver kit, SRI \$27.95
Shortwave converter kit, SCI \$24.95
Matching case set for SRI, CSR \$12.95
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2, 6, 10 MTR, 220 FM RECEIVERS



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FRG-8800 G	Call \$
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FT-790 A	Call \$
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Double the Fun with Dual-Band

Something to think about before you buy.

by Gordon West WB6NOA

If you are thinking of new equipment for VHF and UHF, or a new omnidirectional VHF/UHF antenna system, consider the merits of going dual-band. Even though you may be looking to replace that old mobile unit with a new 2-meter-only set, do consider the advantages of a dual-band system.

In most major cities, the 2 meter band is wall-to-wall signals. In fact, there is so much FM activity on 2 meters that irresponsible operators are trespassing down to the SSB and satellite portions of the band, or running voice where packet should be. Operating outside of the 2 meter FM bandplan is simply due to congestion.

Also, in most parts of the country, the 70cm or 440-450 MHz band is still wide open for voice simplex, FM repeater, and digital networks. Ten MHz of elbow room is available to all types of FM stations and digital stations on the 440 band. Propagation on this band is almost identical to 2 meter, line-of-sight (LOS) propagation.

In downtown areas, the 440 MHz band improves the capability of getting a signal out from underground parking garages, elevators, and metal buildings, which would normally attenuate 2 meter signals. This makes the 440 band ideal for FM repeater, packet, and FM simplex transmissions.

Dual-Band Transceivers

The dual-band transceivers cover 144-148 MHz TX/RX (transmit/receive) for 2 meters, and 440 MHz-450 MHz for 70cm.

Some dual-band equipment may also transmit and receive down to 430 MHz, but 430-440 MHz is generally reserved for weak-signal work, auxiliary/repeater links, SSB and CW satellite work, and ATV operation. The area from 420-430 MHz is almost exclusively ATV, so this is why many dual-band transceivers won't go down that low.

Your dual-band transceiver may also feature out-of-band receive capabilities. This lets you snoop around on VHF and UHF commercial, state, and federal frequencies, though you must be sure not to tune into any communications specifically considered illegal to

monitor in your state.

Many dual-band sets now also offer AM aeronautical reception from 110-130 MHz as an added bonus. This is just one more fringe benefit you receive if you buy the dual-band mobile or dual-band hand-held transceiver covering 2 meters and the 70 cm/440 MHz bands. Besides a ham transceiver, you also receive a powerful scanner.

The dual-band mobile transceivers for 2 meters and 70cm most likely feature two antenna jacks. It's not hard to see why manufacturers decided to go this route—two antenna jacks for two separate antenna systems, right? Maybe so in the old days, but now that almost every major antenna manufacturer provides mobile and base omnidirectional dual-band antennas, the two-jack mobile transceiver will need a device called a duplexer.

What the duplexer does is combine one single dual-band antenna input to two separate transceiver inputs. The duplexer keeps the VHF transmitter from blowing up the UHF receiver, and vice versa, even though both coaxes from your mobile transceiver disappear into this single box that terminates to a single coax output.

But you'll need to pick your duplexer carefully. Some dual-band mobile transceivers feature a conventional SO-239 jack for the VHF 2 meter antenna, and an N-connector jack for the 70cm side. Your duplexer must have the right connectors to bring these different style jacks into the inside circuitry. Sure, you could always use an adapter, but these



Photo A. Dual-band - the way to go.

gobble up small amounts of RF, and it would be better to minimize the number of connections in between your set and the duplexer.

Same thing for the output to the single coax—some duplexers may want to see an N-connector, but maybe your coaxial cable run is going to feature PL-259s. Figure this out ahead of time, before you leave the radio store with your new set under your arm.

For hand-held dual-band transceivers, a single BNC connector on the top of the HT feeds both internal bands. I would caution you not to use RG-213, RG-8/U, or even RG-8X for an adapter that goes into the top of the hand-held. The bigger coax will sometimes work the hand-held's BNC jack loose from the circuit board, and then you have major problems. Rather, use some very small 50 ohm

coaxial cable for the first couple of feet off your hand-held, and then join it to larger coax that leads to your dual-band base antenna or the roof of your vehicle. This keeps the strain off of your HT's fragile BNC connector.

If you're running two separate antennas to your dual-band hand-held, you will need to consider the duplexer again. The duplexer takes the two antennas and combines them into a single output that goes to your hand-held transceiver. It's the same duplexer that you might have used for your mobile unit—just turned around. Either way, it works the same in splitting or combining the 2 meter and 70cm 440 MHz bands.

For mobile coaxial cable runs, both Comet and Diamond Antenna Companies offer antenna mounts in every configuration known to mankind, featuring low-loss coax along with a duplexer, if needed, for the mobile transceiver. For the hand-held transceiver, they also offer coaxial cable mount kits with low-loss coax that magically terminates to about a foot of tiny coax into a BNC plug in the top of your hand-held.

Good thinking here—a wide variety of mounts and cables specifically designed for single-band, dual-band, and tri-band operation on VHF. Diamond and Comet are also the largest suppliers of unique no-holes antenna mounts and single-, dual-, and tri-band antenna systems, all requiring only a single coaxial cable run. And both companies also offer a wide variety of duplexer and triplexer boxes for an easy connection to your hand-held or mobile transceiver.

Spurred by Competition

It didn't take U.S. antenna manufacturers long to recognize some of the smart engineering in both the Comet and Diamond Japanese antenna systems, and

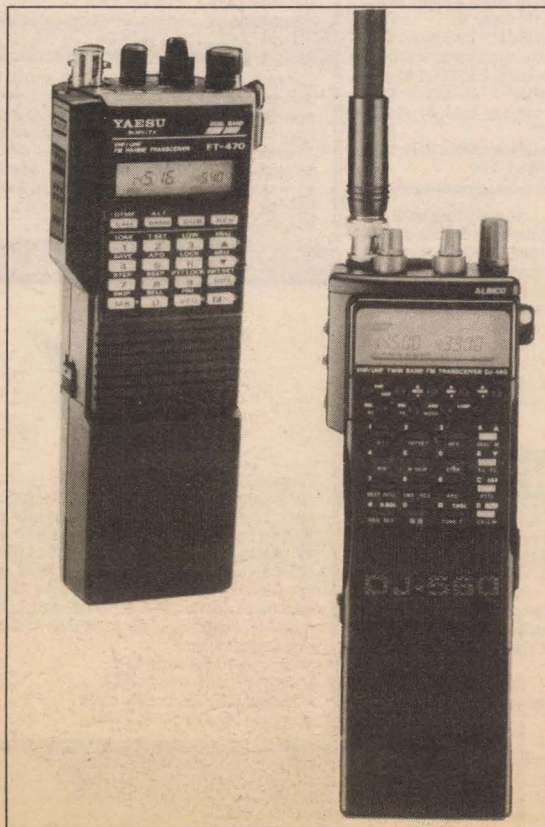


Photo B. These dual-band HTs read out both bands at the same time.

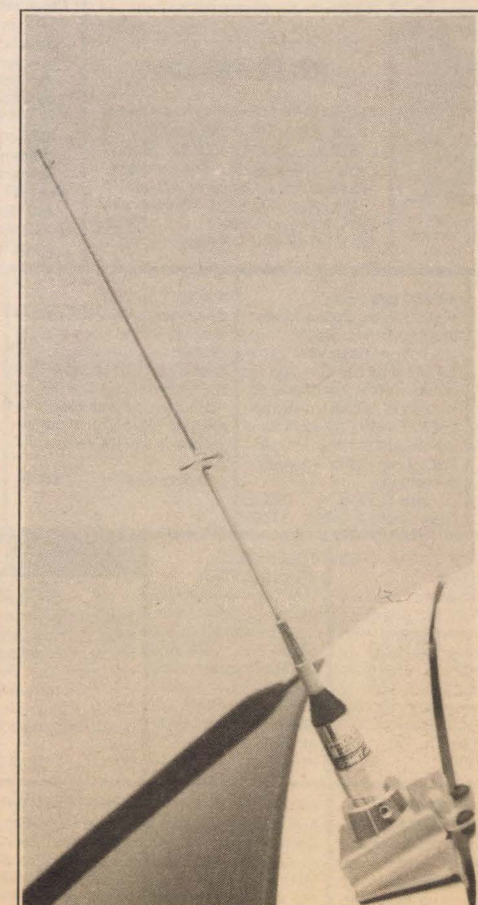


Photo C. The dual-band whip is not much longer than a short 2 meter whip.

to switch from one-band-only VHF operation to two-band. Almost simultaneously, mobile antenna giant Larsen introduced the KG2-70 dual-band, glass-mount antenna, following in the footsteps of their Japanese competition. Mobile Mark offered the dual-band on-glass antenna. Both Diamond and Comet are leaning toward the sturdy no-glass mount, while Larsen and Mobile Mark work through-the-glass technology.

"At 2 meters, our Larsen antenna delivers 2.5 dBd gain, and on 70cm, we get 4.5 dBd gain, and none of our on-the-glass antennas require a ground plane," said Jeff Barnd at Larsen. The Comet and Diamond antennas also work without the need of a ground plane, and their dB gain is comparable to the gain achieved from on-glass antennas of the same approximate height. Generally, the taller the antenna and the more collinear sections stacked end-to-end, the lower the main lobe of radiation and the higher the gain. To compare the gain of dual-band mobile antennas, simply look at their height and capabilities of staying straight up at highway speeds. The more elements stacked in a collinear array, the greater the height, and the greater the gain.

Japanese antenna manufacturers Comet and Diamond were also the first to promote high-gain, dual- and tri-band fiberglass base antenna systems to the amateur radio community. Inside the fiberglass radome were phased elements, stacked end-to-end in a collinear array, for extremely low take-off angles and dual-band operation from a single feedline. These high-gain, dual-band antennas came with a variety of base mounts, and all featured a coaxial cable connector—end connector of SO-239—for heavy duty coax hook-up. If you're thinking of buying one of these antennas, choose whether or not you want to terminate to an end connector or to a conventional PL-259.

These Japanese dual-band antennas were terrific performers. They

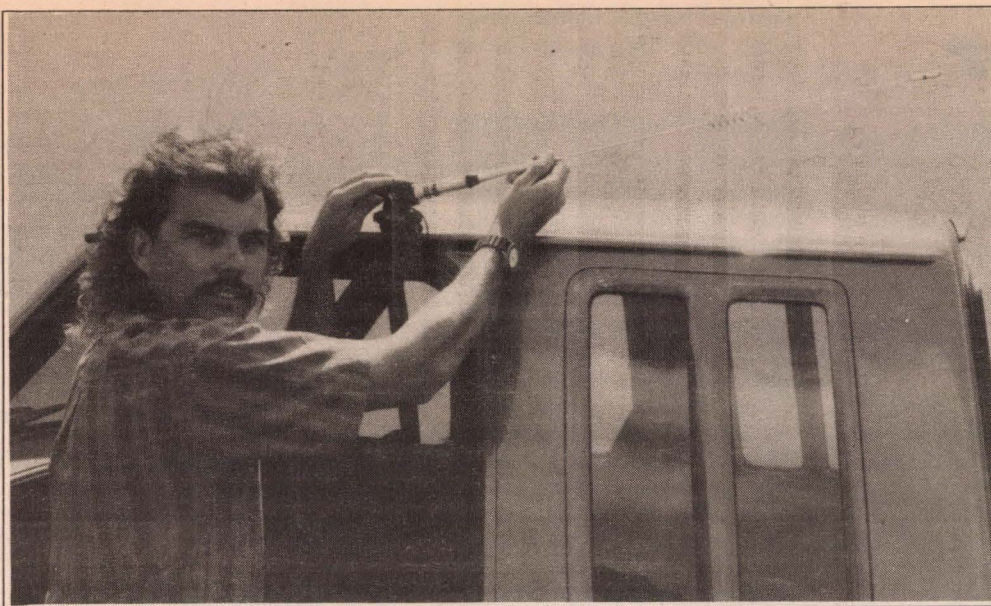


Photo E. Mick Stwertnik at Comet demonstrates the lay-down feature on their dual-band whip.

were lightweight, fully assembled, and only took seconds to mount.

The New Hustler G6-270

Now enters the new dual-band antenna from Hustler, Newtronics Antenna Corporation, the Model G6-270, patterned after their well-known G7 and G6 single-band base and repeater antennas. The new G6-270 offers both 2 meter and 70cm dual-band capabilities terminating to a type-N female connection.

A local ham radio dealer in Southern California said, "It stands 7 feet 6 inches tall, and weighs only 5.3 pounds. Sure, it's a little heavier than the white fiberglass imported antennas, but this antenna can really take mountain-top abuse." On testing the G6-270, I agree that it's a lot heavier than Comet or Diamond base antennas. It mounts to a 1-1/4" to 1-1/2" mast with supplied U-bolts and a mounting plate. It was rated at 6 dB gain for VHF and also UHF, dBd. The design is collinear, 5/8-wave over 5/8-wave on VHF, and four 5/8-wave

als to insure the RF all stays up there in the radiating elements.

The Hustler comes pre-tuned, but the hose clamps may be loosened in case you want to favor any particular portion of either band.

In a side-by-side comparison (of course, separating the antennas so they would not interact), I tested similar-length Comet and Diamond antennas against the Hustler. The results were so close that you really couldn't hear the difference between the participating distant mobile stations on simplex, the hand-held stations, and repeater stations over 80 miles away. On transmit, all the similar-length dual-band antennas performed about the same. This once again proves that similar-length antenna systems will perform equally well as long as they don't come down or blow away in a wind storm.

Most repeater owners would probably prefer the most substantially built antenna possible at the top of their tower. Many will go for the Hustler dual-band because of its extra-sturdy construction and hefty base-mount supplied bracket.

So if you're thinking of going for a new single-band transceiver, do consider dual-band operation.

for heaven's sake go for a dual-band antenna and have your antenna capabilities ready when you switch from one band to two bands on VHF and UHF. **RF**

Gordon West WB6NOA is a columnist and regular contributor to Radio Fun. He is the owner of Gordon West Radio School, and he travels around the country conducting ham radio licensing seminars.



Photo G. Radials quickly attach to a Hustler dual-band antenna with a nut.

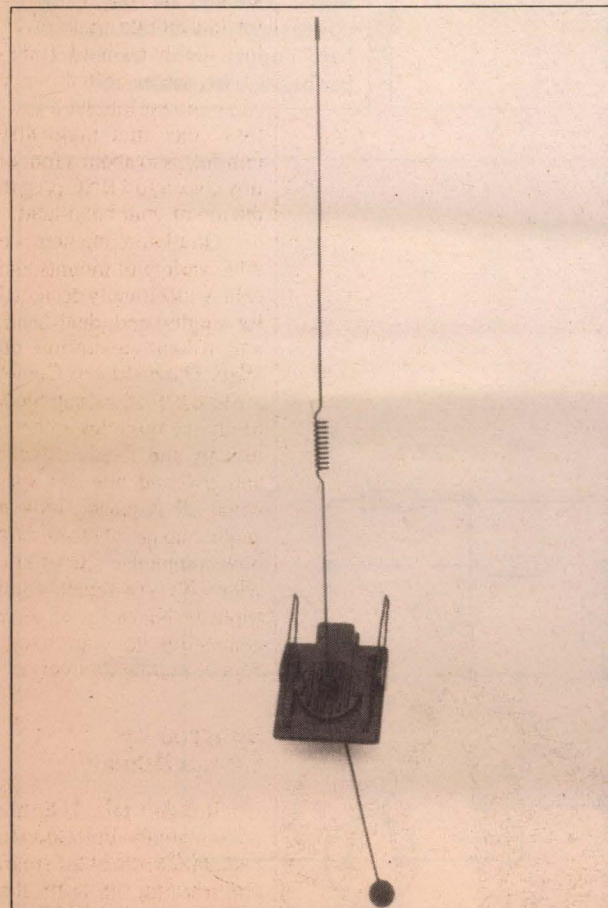


Photo D. Dual-band "on-the-glass" antennas are great performers and don't require a ground plane.

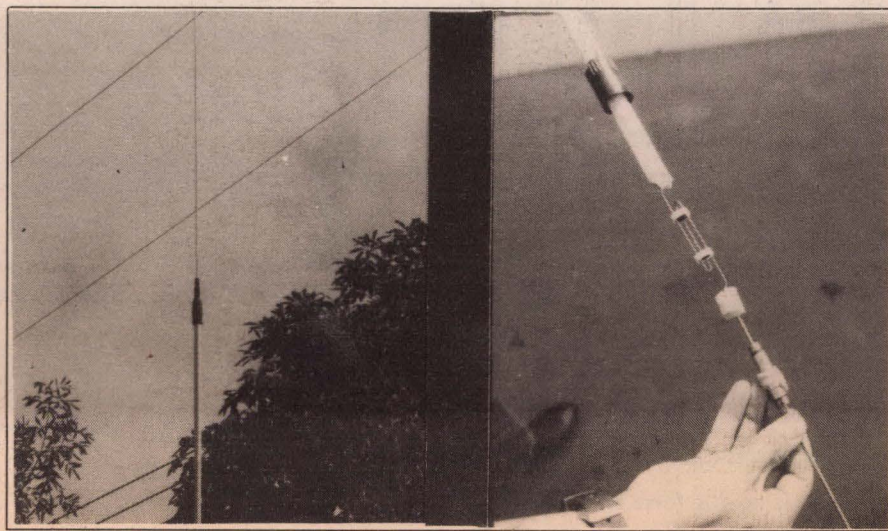


Photo F. The dual-band fiberglass Comet base antenna — a look outside and inside.

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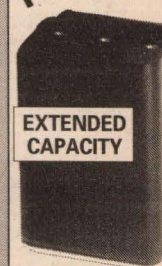
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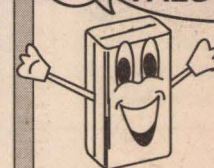
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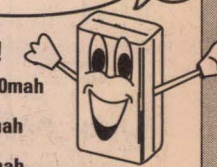
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Easy Switcher

Control four rigs, two antennas.

by Charles D. Rakes KI5AZ

If you're a hands-on ham who enjoys checking out a new QRP circuit or helping a fellow ham test a newly acquired rig, or if you just like the convenience of flipping a switch to connect a different rig to your antenna system, you might consider building this versatile coaxial switcher.

The Easy Switcher accepts up to four different rigs that can be switched to a choice of two antennas, or two tuners with as many antennas as the tuner has switch positions. The circuit can be expanded to add as many input/output positions as desired. To keep things smoke-free, there's a built-in alarm circuit that warns you if more than one rig is switched to the same antenna position. This Murphy alarm feature makes the Easy Switcher almost foolproof without taking away from its basic design simplicity and low construction cost.

How It Works

Five double-pole, double-throw appliance-type rocker switches control the RF flow to and from the six chassis-mount SO-239 connectors. See the circuit diagrams in Figures 1 and 3. S1 selects the antenna or tuner that's connected to either the "A" or "B" input and ties it to the S2—S5 input buss. S2, S3, and S4 are shown in the down or "off" position. S5 is in the "on" position connecting the input buss to the number "4" (J6) connector.

The other half of S5 switches R4 to circuit common, or ground. The voltage at the junction of R4 and R5 is equal to one-half of the supply voltage. Q1, a PNP transistor, is connected in a switching circuit with R6 and R7 setting the emitter voltage to one-half of the positive supply voltage. Since Q1's base is tied to the

junction of R4 and R5, the emitter base voltage is zero and Q1 remains off.

If any other switch, S2—S4, is switched on, the voltage at the base of Q1 will become more negative than its emitter, and will turn on. Q1 supplies base current to Q2, turning it on and sounding the piezo sounder. Power for the alarm circuit is sup-

plied by a 9-volt DC wall plug power supply. All of the capacitors are for RF bypassing.

Building Your Own Switcher

A 12" x 2-1/2" x 2-1/2" two-piece aluminum enclosure was used to house the switcher, but any similar-size metal cabinet will do just as well. The five rocker switches are evenly spaced across the front of the cabinet, and the six SO-239 chassis connectors are mounted to the back of the cabinet behind each switch.

Number 12 bare copper wire is used for all of the RF wiring. Refer to Photo A. To ensure a good ground for each of the chassis mount SO-239 connectors, mount a solder lug with each one, and tie them together with a run of number 12 wire.

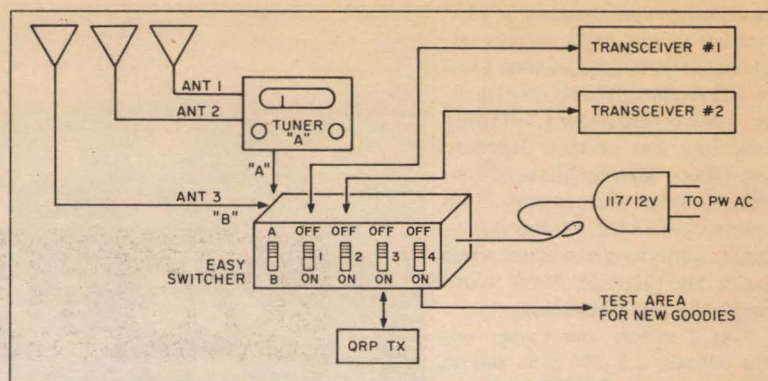


Figure 2. Block diagram to show hookup.

A postage-stamp-size piece of perfboard holds the alarm circuitry, and is mounted at one end under the piezo sounder.

Checking Out the Switcher

Set S2—S5 to their "off" position, and plug in the 9-volt wall supply. The piezo sounder should be silent. Turn any two of the switches on, and the piezo should sound off. If so, you are ready for some easy switching.

Some parting comments. I've used the switcher for over two years, and have checked out at least a dozen HF rigs with power outputs ranging from a few milliwatts to over 200 watts without a hitch.

The layout shown in Figure 2 is close to the setup I use at station KI5AZ.

RF

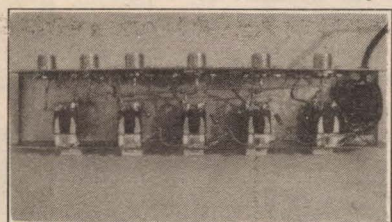


Photo A. Internal view of the Easy Switcher.

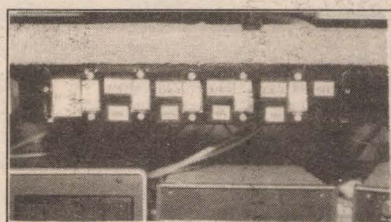


Photo B. Front view with rocker switches.

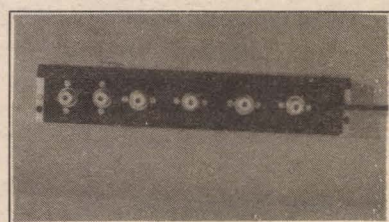


Photo C. Rear view with SO-239 connectors showing.

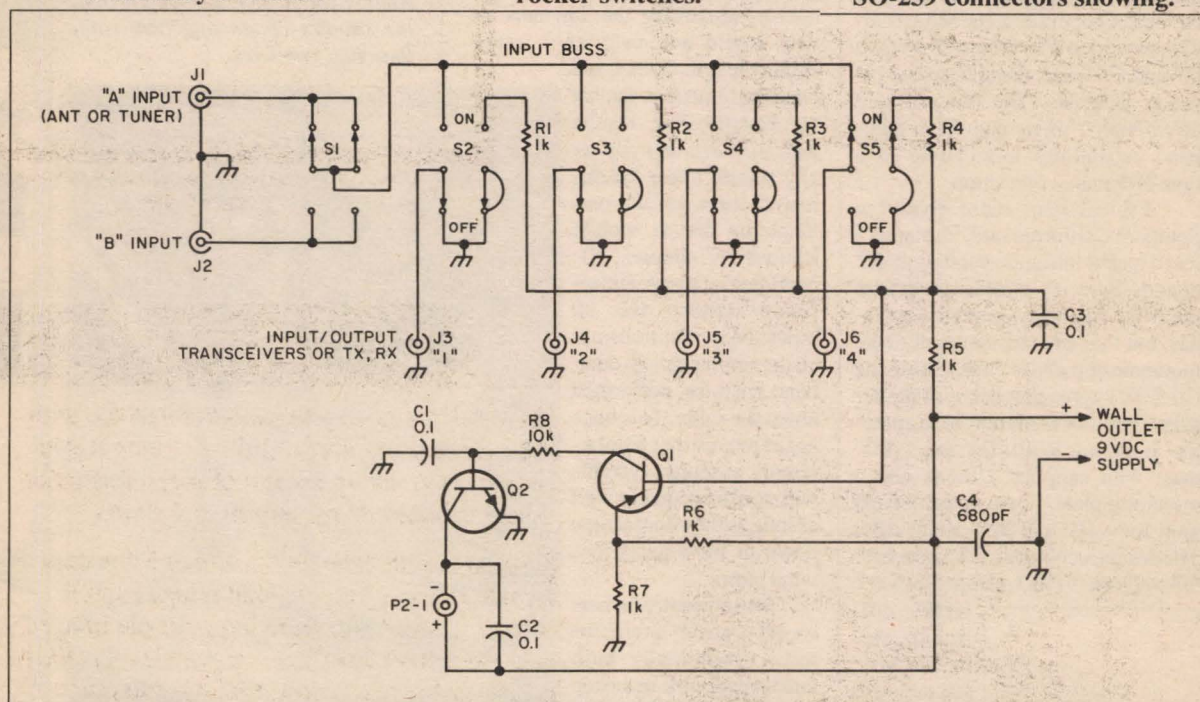


Figure 1. Schematic for the Easy Switcher.

Parts List

- C1,2,3 0.1μF, 100V disc ceramic capacitor
- C4 680 pF, 100V disc ceramic capacitor
- S1—S5 DPDT rocker switch, 10 amp appliance type (Radio Shack # 275-691)
- J1—J6 SO-239 chassis connectors
- Q1 2N3906 PNP transistor
- Q2 2N3904 NPN transistor
- PZ-1 piezo sounder (with built-in oscillator) (Radio Shack # 273-066)
- R1—7 1k, 1/2W resistor
- R8 10k, 1/2W resistor

Misc.: Nine-volt DC wall plug power supply, metal cabinet, #12 bare copper wire, hardware, perfboard, wire, solder, etc.

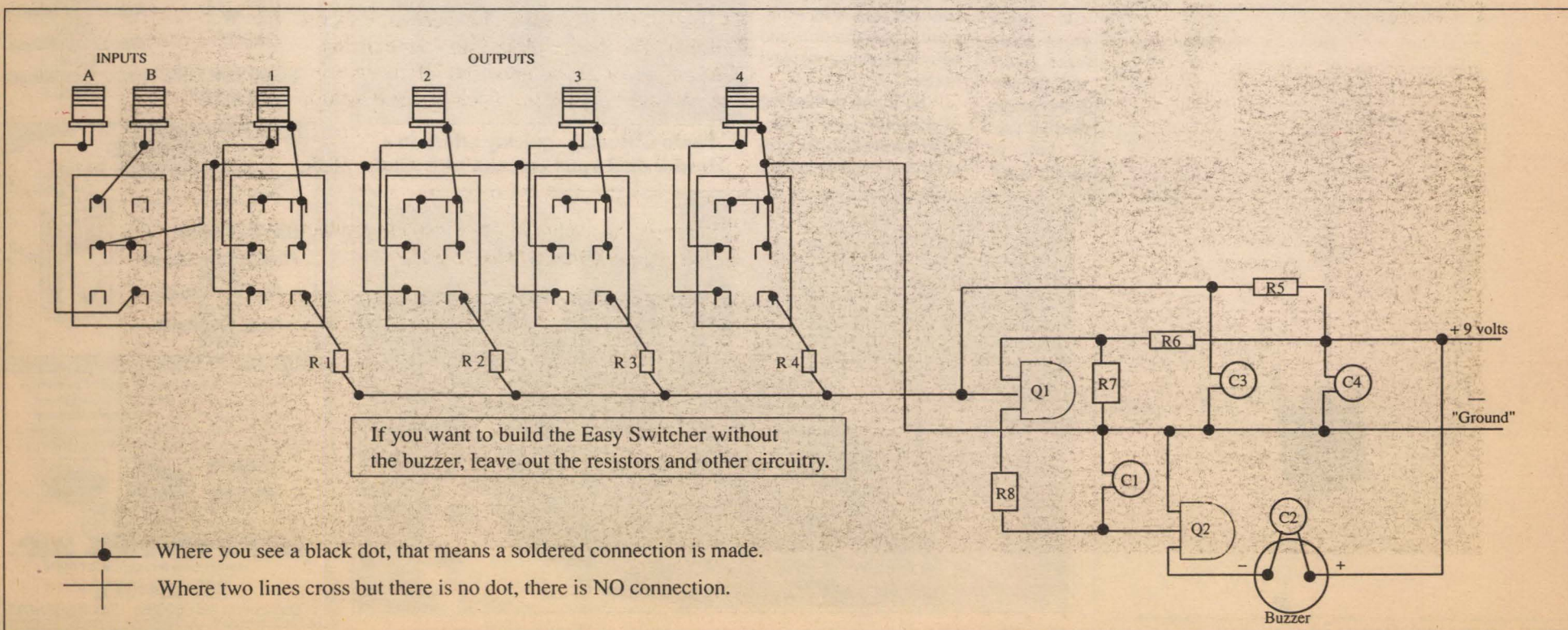
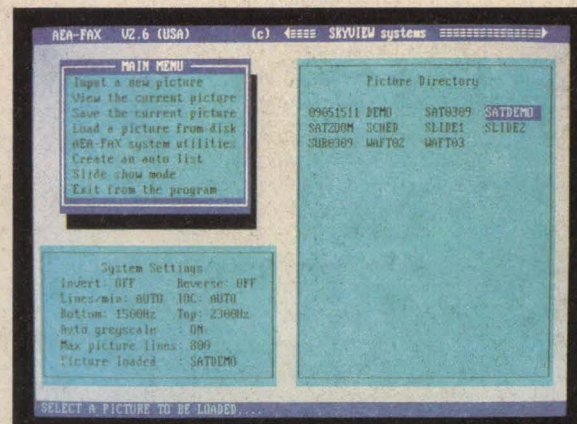
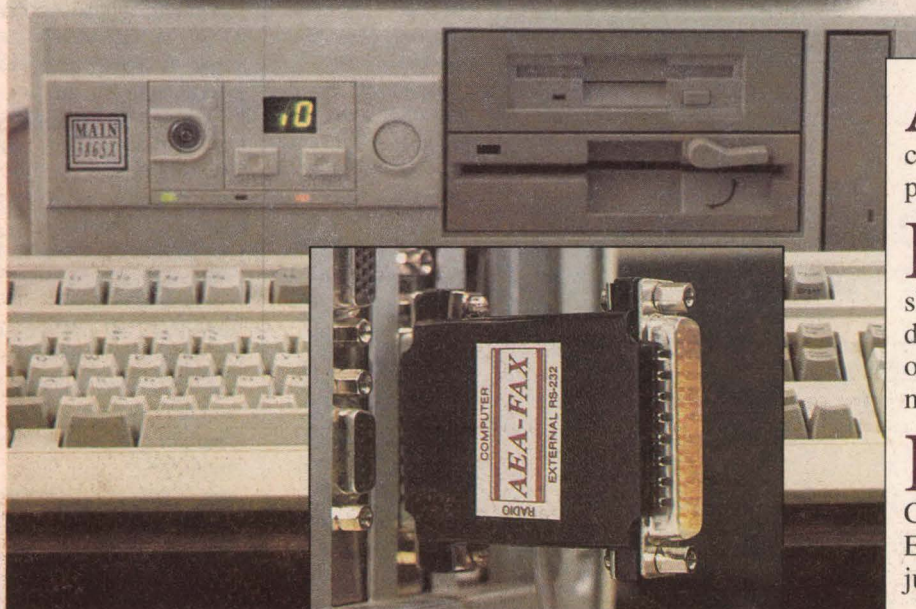


Figure 3. Wiring diagram of the switch terminals and the buzzer circuit.

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Pearl Harbor Special Event Station

Commemorative station report.

by Ann Shaver AH6KY

If "all's well that ends well," then all must be fantastic that ends successful beyond imagination.

Indeed, KH6SP, the special event station marking the 50th anniversary of the attack on Pearl Harbor and other Oahu military sites, was extremely fruitful. "I thought the event turned out great. Our months of planning paid off. It's too bad, though, that there isn't some centralized registry of special events or some way to coordinate efforts. That would have made things a lot smoother in the weeks before our commemoration of Pearl Harbor," observed Joe Weite KH6GDR.

Covering all bands, all modes, KH6SP was on the air for 37 hours. Major transmitting sites included two Field-Day type operations at Pearl Harbor and the Army and Air Force MARS stations. More than 30 Honolulu hams logged over 3,500 contacts using HF CW and phone, VHF, and slow-scan TV. No contacts were made via satellite, but it wasn't for lack of trying! Perhaps most important, everyone involved (in Hawaii, anyway) thinks the special event was a lot of fun.

"This was just great," said Joe Hao WH6F, state director of Army MARS. "Marcus and I would like to do something like this every month," he continued, referring to Marcus Reed WH6D area director of Army MARS. The Army MARS site at Schofield Barracks in central Oahu was open to all interested hams. Many participants there were not MARS members—when they arrived, anyway.

"I heard about this over the repeater, and it sounded like fun. I'm really glad I came over here," Allan Alexander WH6DM related. This is a nice bunch, and I know I'm going to enjoy being a part of things." A codeless tech with a brand-new license, Alexander is looking to upgrade to General class soon. And yes, he was a member of Army MARS when he left the station in the late afternoon to pick up his wife. "After dinner, I hope I can persuade Theresa to come back over here. She might enjoy it!"

KH6SP Grew from Plans for Two Events

Originally planned as two parallel events, KH6SP evolved from the efforts of a diverse group of Honolulu amateurs who did not want the historic anniversary to pass unnoticed, and some Navy MARS members who had an obvious interest in the occasion. In late November, the two groups decided to join forces and stage a mega-event, sharing the callsign and coordinating use of frequencies.

"I got here and it was hot and our bands were dead," remembered Al Sadowski AH6LS, who first oper-

ated at the Army MARS station and then went to the Air Force installation at Hickam Field. "I remembered how good 17 meters had been in the afternoon, and I knew they had a lot of food and beverages over there at Schofield. So I figured, why not make a phone call and see if I could improve things for us over here at Air Force MARS!"

One phone call later, and the right to operate KH6SP on 17 meters was transferred from one site to another.

"I can't believe she did it," sighed Richard LaChance AH6IO, control operator at the Army MARS station, referring to one of the Schofield operators. "No one wanted the WARC bands when we were planning the frequency allocations, and I was delighted we had them for the entire duration of the event. Then she just goes and lets the Air Force guys have our prize. Oh well, no harm done."

"About that time Joe Pollard WH6CMI showed up with his keyer. He went to town on 30 meters, making an awful lot of people happy."

Detailed Plans for Band Sharing

"Just when our time came to operate 20 meter phone, the Navy MARS guys at Ford Island called us," John Elliott AH6BJ, control operator at the Richardson Field site explained. "They said they had a big pile-up going, and they wanted to keep the frequency. Our operators were enjoying 10 and 15, so I figured, why not let them keep it. Sure we would have made more contacts if we had had 20, but who cares? This wasn't

a contest. A lot of people at our station don't get much chance to be on the air, and we were really glad they had this opportunity."

"KH6SP was on all bands, all modes and up for more than the 24 hours originally planned. That provided plenty of opportunity for folks

the world over to reach us, and it gave us the luxury of letting slower, less experienced hams have a chance to have some fun."

Am-Bushed at Richardson Field

Elliott was actively involved in several phases of planning KH6SP. Specifically, he was responsible for obtaining the right to use the callsign, which had been assigned to the Pearl Harbor Sub-base. The call was still valid, but the physical license was nowhere to be found. What's more, the designated trustee had retired and the current trustee needed to be listed. Elliott handled all the paperwork necessary to have the information updated and the duplicate license issued.

Elliott also arranged to set up a station at Richardson Field. On the banks of Pearl Harbor, this site overlooks the Arizona Memorial, where President Bush led televised ceremonies. "We had a lot of help setting up Friday night. Unfortunately, we also had a lot of help from Mr. Murphy," laughed Gabriel Keress N6VQE, referring to Murphy's Law.

"The wind that night was horrible. Every time we turned around, Murphy got us. We got the KLM antenna up and found it wasn't working properly. John got out his ohmmeter and his flashlight and checked for continuity. Then we discovered the final was bad in one of the transmitters. Fortunately Hart had his rig along and donated it," Keress continued, speaking of Hart Akagi KH6BIO.

"People who just showed up to operate can't imagine what was involved to get this all set up. It required a lot of team work. John (Elliott) especially deserves recognition. He wasn't selfish, he did an outstanding job on the paperwork, the equipment, all the details. The whole world was focusing on us, but few realize what went on behind the scenes."

"We got ambushed by the traffic," added D.J. Donnarumma NH6HC, who helped with all phases of the

Richardson Field operation.

"The tie-ups Friday night and Saturday morning were just phenomenal. Chris Forman KA0CMG was scheduled to open 15 meter phone at 7 a.m. He and his family arrived about 4 o'clock to be sure they didn't get caught in the traffic for the Punch Bowl Memorial Service at sunrise."

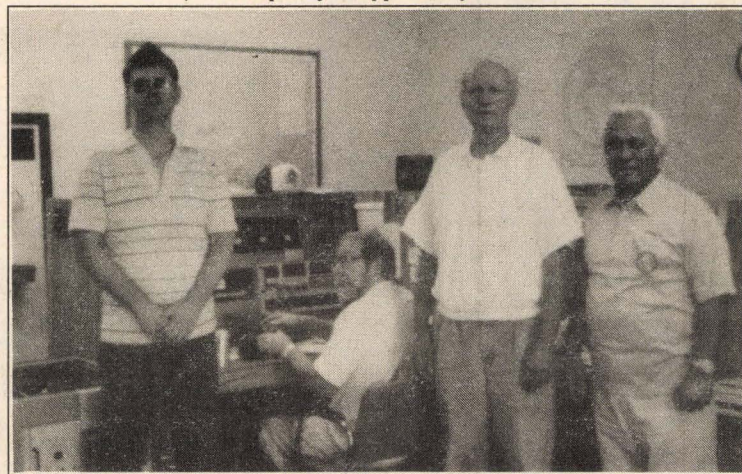
Original Attack Message

Several miles away, in the quiet of his Nanakuli home, Chuck Burch AH6IN transmitted 20 meter CW for 15 hours. "It was very emotional for me to resend the original message telling the world of the attack on Pearl Harbor. I sent it at 0756, 50 years to the minute after it happened. I thought of all the guys still down there at Pearl Harbor with their ships. You know, those ships are still commissioned. I also thought of my own relatives who died in naval battles during World War II." Don Shook AH6A relieved Burch for four hours. "Don and I transitioned so smoothly I'm sure most people didn't realize there was a change."

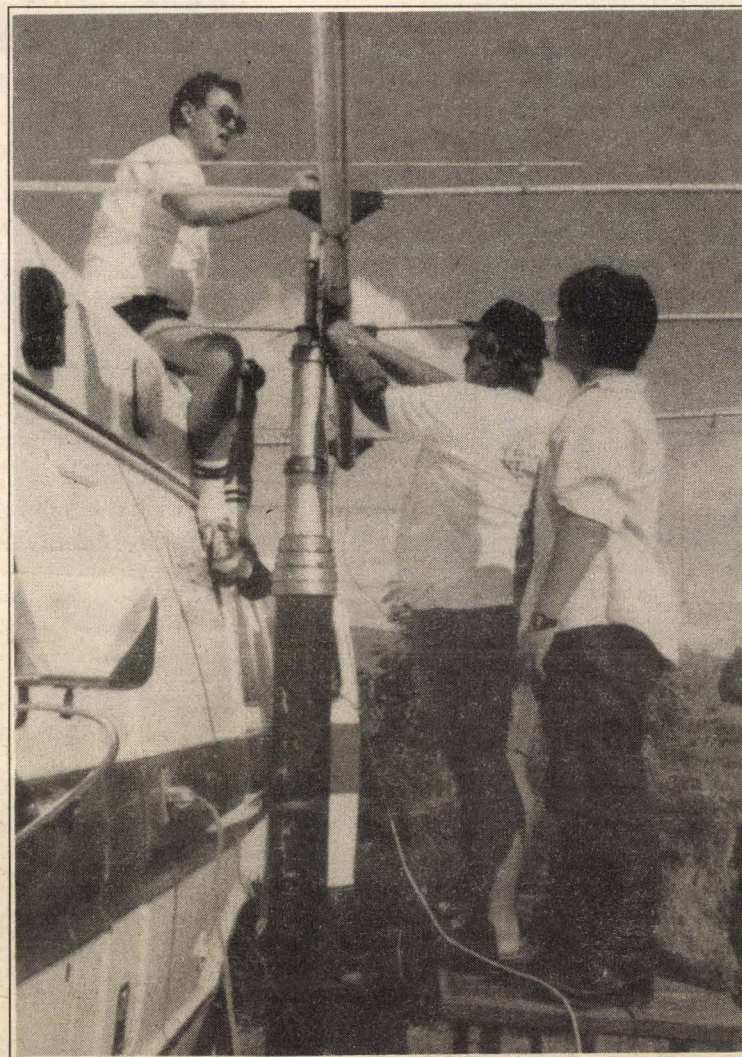
Wayne Jones NH6GJ, QSL manager for the KH6 Bureau, reports receiving a blizzard of cards. "Two weeks after the event, we had already received cards from almost every state. I'm not surprised; all the bands were really active—until they died. When we were up, we were going great guns the entire time."

"I know some people out there were impatient with us because sometimes we were a little slow. I hope they realize that some of our operators were elderly witnesses to the attack, whose emotions still rise to the surface very quickly," elaborated Al Shaver AH6KX, planning coordinator for the amateur ohana (Hawaiian for "group" or "family"). "We certainly weren't going to tell them to hurry up, say '5-9' and go to the next station. That isn't what this event was all about."

Domingo Correa KH6BRN, Shige Tsuruda KH6V, Nobu Nehei KH6BBK, and Gary Kuwasaki WH6BGC, all on Oahu at the time of the attack, participated at the Army MARS facility. "This is a good tribute to a tragic event," observed Correa. "I'm glad we were part of this memorial." **RF**



L to R: John Miller KA6NEI, Joe Weite KH6GDR, Marcus Reed WH6D and Joe Hao WH6F were among the 15 different KH6SP operators who participated from the Army MARS facility at Schofield Barracks. (photo by AH6KX)



John Elliott AH6BJ (on roof) and D.J. Donnarumma NH6HC (working on the antenna) get ready to erect the beam for the KH6SP Special Event station at Richardson Field. Operating from the Emergency Amateur Radio Club's ambulance, which serves as a communications van, they had views of both the Arizona Memorial and one of Honolulu's finest traffic jams! (photo by KH6NJ)

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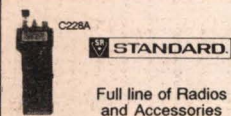


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SAREX Flies Again

Talk to the crew of STS-45

by Philip Chien KC4YER

The upcoming STS-45 space shuttle mission will include SAREX, the Shuttle Amateur Radio EXperiment. Unlike the last two SAREX flights, the STS-45 mission will go into a high inclination orbit, similar to Owen Garriott W5LFL's STS-9 Spacelab 1 and Tony England WØRE's STS 51-F Spacelab 2 missions. Traveling 57.1 degrees north and south of the equator, the shuttle will pass over the most populated areas of the world, including the continental United States. This means that contacts can be made at middle latitudes without phone bridges. Phone bridges were necessary for the STS-35 and STS-37 missions, which flew at the usual 28.4 degree inclination.

The primary payload for the mission, ATLAS-01 (ATmospheric Laboratory and Applied Sciences), contains instruments to gather data on solar, atmospheric, and earth interaction.

What's Special About This Mission?

This mission will be the first flight to include ham operations around the clock. Already interested in SAREX, and with encouragement from ham astronaut Ken Cameron KB5AWP (see "The Flight of STS-37" in the July 1991 issue of 73), astronauts David Leestma, Brian Duffy and Kathy Sullivan took their amateur radio tests and obtained their licenses in time for SAREX to be added to their mission.

Since David N5WQC and Brian N5WQW will alternately pilot the *Atlantis* on 12-hour shifts, one of them will always be available to pick up the radio whenever there's a free moment. More importantly, the pilots have more free time in orbit to operate the ham radio than the science astronauts, who are usually busy with their equipment. On STS-37, the astronauts slept and worked on the same schedule, therefore the ham gear wasn't always in use. On the Spacelab 2 mission, payload specialist John



David-Bartoe W4NYZ was busy working with Spacelab and didn't get a chance to use the SAREX hardware. During the astronauts' free time, just before and after sleep, and any other time when they aren't busy performing their duties, they'll be able to operate the SAREX equipment.

[Editor's Note: A VLF (Very Low Frequency) experiment called "INSPIRE" will be performed during this space shuttle mission. If you would like to find out how to receive this signal and participate in the experiment, read the article called "Project INSPIRE" in the December 1991 issue of 73 *Amateur Radio Today*.]

The Crew

Besides the five NASA astronauts, there will be two career scientists onboard. Originally, these two payloads specialists were supposed to be Byron Lichtenberg and Michael Lampton. When Michael Lampton had to be removed from the crew due to medical reasons, his position was filled by Dirk Frimout ON1AFD from Belgium. Dirk will become the first foreigner to operate a U.S. ham radio aboard a U.S. spacecraft. (During the 1985 Spacelab D-1 mission, the German payload specialists used their own gear under German regulations, and their activities were not part of the SAREX program.) During the

week *Atlantis* is in orbit, Dirk will probably talk to more hams around the world than any other Belgium ham.

An Interview with the Astronauts

Since SAREX was a late addition to the mission, space for storing the ham hardware is limited. The only SAREX gear for the STS-45 mission will consist of the hand-held Motorola 300S transceiver, window-mounted antenna, and enough batteries to use the radio for the week-long mission. No packet, slow-scan or fast-scan television on this flight—it's back to the basics!

At present, NASA is aiming towards a mid-to-late March launch, with current plans calling for lift-off on March 23rd.

[Editor's Note: Keplerian Elements for the space shuttles (used with satellite tracking software) may be obtained from the Public Affairs Office BBS at the NASA Johnson Space Center. Call (713) 483-2500, and enter 62511 at the prompt.]

Astronauts Brian Duffy N5WQW and Dave Leestma N5WQC took some time out from their training to talk about their ham activities. Below are excerpts from an educational video about the STS-45 ATLAS-01 mission:

Dave: "Ken Cameron KB5AWP kind of really pushed SAREX on us. His entire crew on flight STS-37 were ham operators. Brian and I decided that since we were on opposite shifts we'd try to get our licenses... and we did. Since then we've had time in the JSC radio shack to operate, and I've really enjoyed it. It's been a lot of fun."

Brian: "I'm glad we got it in time. The first day I went to the radio shack, I was wondering what it was going to be like. I had never talked on the radio. We fired up the radios with someone there to help. In the span of 15 minutes we talked to West Germany and Norway and Denmark and England and down in Brazil and Costa Rica. When I walked out of there after probably an hour or so, I had a smile on my face—this is great fun. I guess I'm a real convert now."

Dave: "Recently, in fact, twice, Brian's talked to Sergi on *Mir*, and the last time I went over to the shack, I talked with him, too. So we got a chance to know what it's like for the folks up there when they talk to you down here."

Chien: "During your mission, do you expect to talk to the *Mir* cosmonauts in orbit?"

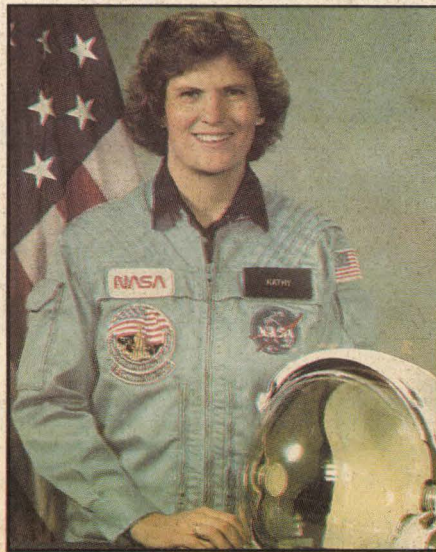
Dave: "I guess that remains to be determined. All we're carrying is a hand-held radio. If it works out and we get a conjunction that's close enough, we'll probably try



Mission specialist Dave Leestma N5WQC.



Pilot Brian Duffy N5WQW.



Mission specialist Kathy Sullivan (call pending)



Payload specialist Dirk Frimout ON1AFD.

to contact *Mir*.

Brian: "But we will be looking."

Chien: "I understand you're going to have enough batteries aboard for the entire mission, so you'll be able to operate the radio close to 24 hours a day whenever you have some free time."

Dave: "We had a long simulation Tuesday, just a couple of days ago, and found out how busy we're going to be. We'll put out the radio as much as we can. We'll probably try to have it available during stateside and European passes, and some Far East passes, too."

Chien: "Are you looking forward to flying over places where you've contacted people on the radio?"

Brian: "Yes, of course. We've told people that we're going to fly, and what our callsigns are going to be. We told them to watch for the launch, as we hope to talk to them from orbit."

Future SAREX

The next potential SAREX opportunity is the STS-50 mission in the summer of 1992, the first long duration (13-day) mission for the shuttle program. The mission commander, Dick Richards, has expressed an interest in becoming a ham. On that mission the SAREX team hopes to include all of the different SAREX activities, including packet, slow-scan, and fast-scan television.

Ham astronaut Jay Apt N5QWL has been assigned to the STS-47 Spacelab J (Japan) mission, currently planned for the late summer of 1992. Since amateur radio is an extremely popular hobby in Japan, the SAREX team has been investigating adding the SAREX gear to that mission with packet and voice modes, with a particular emphasis on talking to students in Japan.

Other astronauts assigned to missions who hold ham licenses include Jerry Ross N5SCW, assigned to the German Spacelab D2 mission currently planned for the spring of 1993, and Linda Godwin N5RAX, assigned to the Space Radar Laboratory, scheduled for that fall. There is no word on whether or not SAREX will be carried on either of those missions.

In any case, as long as NASA's educational department sees enough interest in the SAREX experiment, and Ken Cameron keeps encouraging fellow astronauts to become hams, it's likely that SAREX will continue to be a popular crew activity aboard the space shuttle. **RF**

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145.55 MHz

Shuttle Receive

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144.95

144.97

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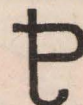
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RF review

The Antex Miniature Soldering Iron

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The Antex Iron

My search ended when I found the Antex miniature soldering iron by M. M. Newman Corporation. Their model G iron is rated at 18 watts and is extremely slim and lightweight. It even comes with a metal shield to protect your fingers from the business end of the iron. The shield also serves as a support for the iron

when you lay it down.

One of the things that sets this iron apart from others is the fact that the solder tip slides *over* the heating element. This puts the heating element directly under the tip and allows the iron to heat up very quickly.

A Hot Performer

I really liked the way the iron felt while I soldered up yet another gizmo. In fact, the iron is so light I could hardly tell I had it in my hand. One thing I immediately noticed was the really quick warm-up time. With most irons you usually have to wait two or three minutes for the tip to get hot. The Antex was ready to go in just a little over 40 seconds (they advertise 45 seconds). The next pleasant surprise was the quick recovery time after making each solder joint. Thanks to the Antex's efficient design, the tip was ready to solder the next point almost instantaneously. Even though the iron is rated at 18 watts, it has the capabilities of a much larger iron. Anything I could solder with my 30

watt iron I could do with the Antex.

Even though the iron rested nicely on the metal heat shield, I would recommend that you get the companion soldering stand. It's not a good idea to leave a hot soldering iron resting out in the open on your workbench.

A Good Tip

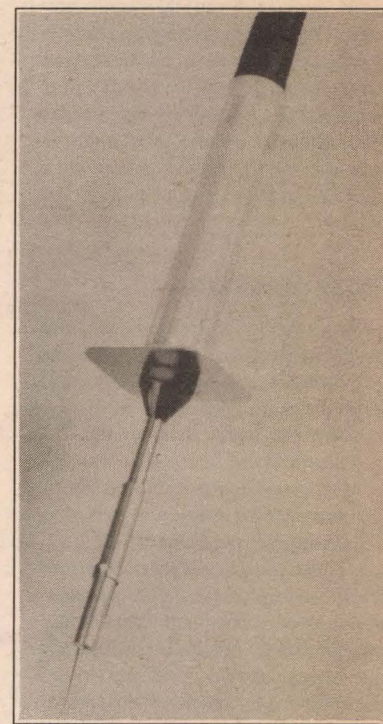
The folks at M. M. Newman offer quite a variety of tips for the Antex iron. They are available in either nickel or gold. I tried out a large nickel flat blade style (chisel tip #2NC) and a very fine-point gold tip (model #8). The large flat blade was a little too large (and produced too much heat) for small connections. However, it was perfect for larger components and quite useful for making up connectors. The fine-point gold tip was great for soldering just about any component on a printed circuit board. It even worked exceptionally well on surface-mount components (usually a real pain when I used my large solder station).

Each tip slid neatly over the end of the heating element and was easily removed when I needed to change to the other tip. You do have to let the iron cool off before you change the tip, however! On my solder station, I usually just change the tip while it is still hot by grasping it with a small wrench. This technique didn't work very well with the Antex since the tip fits very snugly to the end of the iron. The Antex tips do cool off rapidly when the iron is turned off, however.

Impressions

The Antex soldering iron has found a permanent place on my workbench. Don't be fooled by its miniature size. This is a good all-around iron for everyday soldering needs. Not only that, it's very reasonably priced. **RF**

When he's not at home sniffing solder fumes, Bill Brown WB8ELK is the Managing Editor of Radio Fun. You may write to him c/o Radio Fun.



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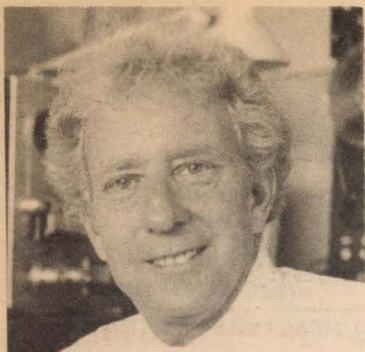
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upgrade . . . don't stop now

by Gordon West WB6NOA

Upgrades for the Handicapped

If you are disabled, the amateur radio service welcomes you with open arms. Disabled amateur radio operators are the backbone of public service nets, repeater "traffic watch" programs, and a friendly voice on the other end of the radio when there is someone out there in a jam needing a land line to the police or their loved ones.

Study Materials

For the visually impaired, the *Radio Amateur Callbook* offers mail-order theory cassettes covering all written examination elements:

- Novice Theory, Element 2
- Technician Theory, Element 3A
- General Theory, Element 3B
- Advanced Theory, Element 4A
- Extra Theory, Element 4B

These cassettes feature a fun and lively review of every theory question, voiced verbatim on the cassette, plus the four possible correct answers, the correct answer, and then a description of why this particular answer is indeed the right one. It's this voiced description behind every question that allows the visually impaired to better understand the question and the right answer. (*Radio Amateur Callbook*, (908) 905-2961)

For the hearing-impaired applicant for an amateur radio license or upgrade, a CW flashing light may be just as good as hearing the actual dits and dahs. CW light assemblies could be built out of plans from the *Radio Amateur Handbook*, or even "DJ specials" are available from your local music equipment store. These are little black boxes that will trigger a light as soon as they detect any audio sound. We see them a lot in discos, and they make great CW flashing light sets that work right out of the box! In fact, in our Radio School classes, we have a string of lights to allow multiple hearing-impaired operators to watch the code as others are listening to it.

Learning the code and upgrading your code speed with both a visual and aural impairment is a simple matter. An open speaker serves as a vibrating transducer for the dits and dahs. The blind-deaf applicant tunes into the code by simply feeling the vibrations off of the speaker. If the blind and deaf applicant doesn't know the code, the Courage Handi-Ham System (Golden Valley, Minnesota; (612) 520-0511) can assist with making contact with Braille Institute for their CW learning programs. The Handi-Ham System also has excellent code and theory learning programs, specifically for the disabled ham operator.

Testing Opportunities

If you're getting into ham radio for the first time, or know of a handi-

capped individual just getting started with ham radio, it's best to let them first test in front of a team of three accredited volunteer examiners. Even though two local, qualified, General class hams could give the Novice test, the team of three accredited volunteer examiners may know more about what they can do to accommodate the handicapped applicant.

"Special telegraphy test accommodations must be made by the VE team at all testing speeds for disabled examinees," comments Fred Maia W5YI. "These special CW tests may include requiring a telegraphy-sending test instead of a receiving test—or, where warranted, pausing the test tape after each sentence, phrase, word, or individual letter," adds the W5YI-VEC.

The three-member volunteer examination team may also go into homes or hospitals in order to provide testing for the physically disabled. If the applicant is unable to move out of their bed, the three examiners may conduct the exam right there — one on one!

The volunteer examination team will normally take into account the

"If you are disabled, the amateur radio service welcomes you with open arms."

severity of the handicap. They might read a specific question, and then allow the applicant to simply paraphrase what he or she feels is the right answer. In other words, reading an applicant a test question, and then reading the four potential answers is tough. Instead, let the applicant answer in their own words the question that was just asked.

Severely Handicapped Amateurs

The Federal Communications Commission will allow a CW waiver for the 13 and 20 wpm code test for a doctor-certified severely handicapped applicant. This would be a last resort situation—most severely handicapped amateurs could still pass a 13 wpm or 20 wpm code test if the tape was stopped and started after every word or every letter. This is permissible. The 13 and 20 wpm waiver is in place when any other type of special telegraphy test just doesn't seem to work.

The disabled amateur must have the 5 wpm code Element 1A passed before they seek the 13/20 wpm

waiver. NO waiver will be issued if the applicant has never passed a 5 wpm code test.

The applicant should contact their local volunteer exam coordinator or volunteer examination team and get the proper waiver application form. The doctor signing the form must be an M.D. or Doctor of Osteopathy. This severe handicap must also have lasted for more than a year in order to qualify for the waiver.

The doctor and applicant fill out the waiver, and the certification of disability must be submitted through a VE team. It may not be sent directly to the FCC or directly to the VEC. The applicant and the application must first show up at a VE session.

The volunteer examiners will receive the form, check it over, and then have the applicant fill out a Form 610. Volunteer examiners will issue a CSCE (Certificate of Successful Completion of Examination) for the 20 wpm code requirement, when an applicant presents a properly completed doctor's certification and patient's release form. That's right, 20 wpm.

This CSCE may be used during the following year for 20 wpm telegraphy credit in the event the applicant has qualified for the General or Advanced class, which requires only 13 wpm code proficiency. The applicant may operate immediately with the new upgraded privileges, just as if they had passed the telegraphy examination.

But VE teams throughout the country are beginning to see some abuses to this program. Perfectly healthy-looking applicants, easily hearing soft-spoken questions from the examiners, are turning in this paperwork and demanding an instant upgrade. Since the Federal Communications Commission does not specifically detail what may qualify as a "severe handicap," some hams are taking advantage of a good thing and spoiling it for those that really need the waiver. And I have little sympathy for the embarrassment that these hams might go through at a VE session when they turn in the form — they look perfectly well, they can hear well, so what are they doing with this form—just getting out of some hard work that the rest of us had put in preparing for the code test? I mean, how much work does it take to pass a code test where the tape is stopped after every single letter?

I also have reservations about the hams turning in these waivers who couldn't tell you the three elements for an "S" or the three elements for an "O." Oh well, there will always be some abuses to special provisions for the handicapped.

But if you are handicapped, take advantage of the special provisions that the volunteer examiners can do for you. We need you in the amateur radio service, and we know your next upgrade will come quickly. **RF**

The School Club Roundup

Being prepared.

by Larry R. Luchi W7KZE

As a child, I was introduced to amateur radio. I continued my studies in electronics with a ham ticket, and successful employment in the electronics industry, for more than 30 years. Then, several years ago, I chose a second career—teaching. Now, as the instructor in electronics technology at Sno-Isle Skills Center, Washington, I spend my time teaching my hobby.

Sno-Isle Skills is a vocational high school that serves 25 high schools with a student population of approximately 850 11th and 12th graders. The school's name is derived from two counties, Snohomish and Island. The Skills Center is located 25 miles north of Seattle in Everett, Washington, where you can see the pristine Olympic Mountains to the west and the majestic North Cascades to the east.

Amateur Radio in Curriculum

Mukilteo School District No. 6 administers the Skills Center. Students are bused to the center for two three-hour blocks of instruction each day, a morning class and an afternoon class. The students receive three elective credits a year for their training. In the third quarter of the first year of this two-year program, I teach amateur radio (communications electronics), and all of my students have their Novice/Technician or higher-level license by the time they graduate from high school.

Last February, our school club entered the Council for the Advancement of Amateur Radio in the New York City Schools. The Electronic Technology students are all members of the TEKTRONS amateur radio club. Our school amateur radio club, the Shack, is located in the back of the classroom.

The School Club Roundup takes place during National Vocational Education Week in February, with over 30 schools participating. This year's School Club Roundup is February 10-14, 1992.

We started preparing for the School Club Roundup at the beginning of this school year by forming a net on the local 146.920 MHz repeater. Our net meets every Tuesday night from 7 p.m. to 8 p.m.. We call it "Learning Center .92." Net control is a different student each month. This gives every student the time to develop communication skills and exchange school homework with other students. The older amateur radio operators help with students' questions. Students from Vancouver

in Canada to Vancouver in South Washington check into the net.

Preparing for the Roundup

When our old Kenwood 830S was in need of repair, Jason Grant N7RMG changed the pair of 6146 tubes to bring the rig up to 100 watts. This was an opportunity for me to demonstrate neutralization.

Steve Myers N7RMN replaced the transmit/receive relay in our Dentron 2500 linear amplifier. Students work together in teams to get all of our station equipment in top working order. Contacts were not limited to just schools; during last year's contest, Devin Colbett KB7NKT worked a station in Tel Aviv, Israel. The TEKTRONS finished third in the contest.

As we prepare for this year's School Club Roundup, the students have checked all the PL-259 coaxial connectors and our five-band trapped vertical.

Before the rainy season returned to otherwise sunny Puget Sound, we had to do our annual antenna repair. Zack Beatty N7UDY climbed to the top of our 70-foot tower to lube the bearings of the mast that supports our four-band beam.

During the 1991 school year, we were in the School Club Roundup for the first time. Using my callsign, W7KZE, we compiled a total of 142,728 points with 456 contacts, working 43 states, 20 DX stations, 48 schools, and five clubs.

The 1991 School Club Roundup top scorer was Sedro-Woolley High School, WY7Q, located just 50 miles north of Sno-Isle Skills Center. Sedro-Woolley's total score was 356,928, with 1,056 contacts, 46 states worked, 12 DX stations, and 15 clubs. Robert Mullen WY7A is the teacher at Sedro-Woolley.

The second top scorer of last year's School Club Roundup was The Radio Club of Junior High School 22 in New York City. Their teacher is Joe Fairclough WB2JKJ. The "22 Crew's" total score was 193,612, with 998 contacts, all 50 states worked, 19 DX stations, and 25 schools worked. All of Joe's students got a turn at the radio.

Principles of the Amateur Radio Service

As we prepare for a School Club Roundup, I remind my students of the five principles of amateur radio:

- Recognition and enhancement of the value of the amateur service to the public as a voluntary noncom-

mercial communication service, particularly with respect to providing emergency communications.

- Continuation and extension of the amateur's proven ability to contribute to the advancement of the radio art.

- Encouragement and improvement of the amateur service through rules which provide for advancing skills in both the communications and technical phases of the art.

- Expansion of the existing reservoir within the amateur radio service of trained operators, technicians, and electronics experts.

- Continuation and extension of the amateur's unique ability to enhance international goodwill.

This year, the students will work on the last of the five principles of amateur radio during the School Club Roundup. The exchange of goodwill is not only between DX stations, but with all radio amateur operators who participate in this educational experience for young hams.

The Skills Center's students in this program will be tuned in to the entire world, learning geography on a continuing basis by pinpointing the locations of cities and countries on the world map located in our classroom.

In the future, we hope to add your QSL card to our map. **RF**

For more information, contact Lew Malchick N2RQ, Brooklyn Technical High School, DeKalb Ave. & S. Elliott Place, Brooklyn, NY 11217.

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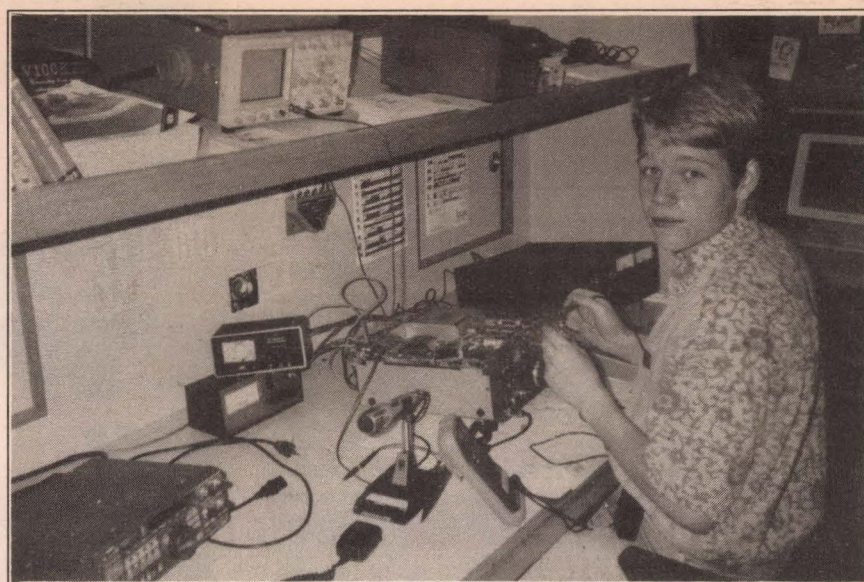
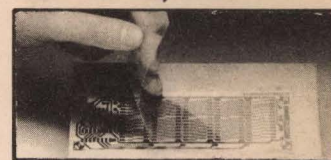


Photo A. Jason Grant N7RMG works on the Kenwood 830S.



Photo B. Zack Beatty N7UDY, the tower climber.

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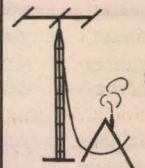
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Radio Fun

MARCH 1992 23



what next?

by Carole Perry WB2MGP

Using SAREX in the Classroom

For the past few years I've had the pleasure of working with Rosalie White WA1STO, the ARRL Educational Activities Manager, on many different projects involving amateur radio in the classroom. If you are a teacher looking for ideas about presenting radio to youngsters, or if you are a ham who wants to help a teacher introduce amateur radio to his or her students, get in touch with Rosalie at 225 Main Street, Newington CT 06111 to find out what resources are available.

Having participated in SAREX with my own sixth-, seventh-, and eighth-graders at Intermediate School 72 in Staten Island, New York, I can attest to the fact that this participation is one of the most highly motivating experiences you can bring into the classroom. Whether you, yourself, are newly licensed or an old-timer, I guarantee that you will get caught up in the excitement of making a contact with an astronaut.

For 1992, the International Space Year, SAREX, the Shuttle Amateur

Radio Experiment, has been manifested on three flights: STS-45, scheduled for launch on March 14 with Pilot Brian Duffy N5WQW, Mission Specialist Dave Leestma N5WQC and Payload Specialist Dirk Frimout ON1AFD; STS-50 in June with Commander Dick Richards who plans to have his license by February; and STS-47 in August with Jay Apt N5QWL who did a space walk last April on the STS-37 flight.

I asked Rosalie to offer some suggestions for teachers or individual hams who want to know "What Next?" when it comes to the SAREX program. The following information comes from her, and she is your best resource for SAREX updates.

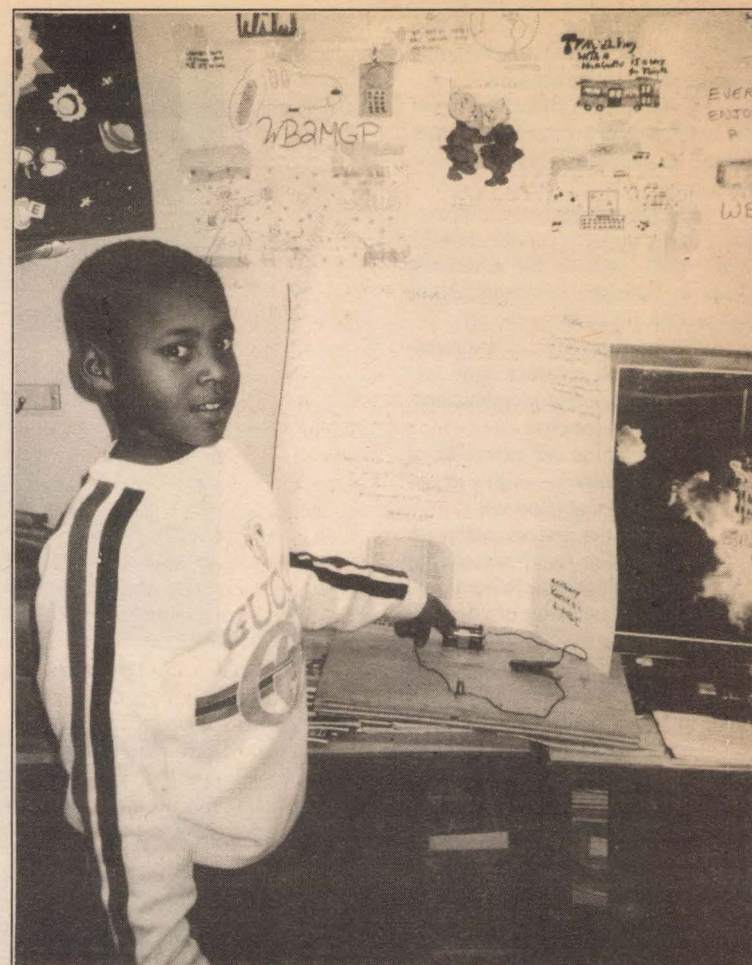
"Just about every young person likes activities that involve astronauts, shuttles and outer space. The excitement of countdowns, the risk of going into orbit, and the unknown that might be found during missions, spark young people's imaginations and often lead to inquiries that develop understanding and learning. Why not tie in some of this excitement with a subject you or a friend might be teaching in school? At the same time,

you can introduce the students to amateur radio. How? Through SAREX.

"SAREX takes place when shuttle crew members who are licensed hams get to operate amateur radio during their shuttle flights. With the work of a lot of volunteers from NASA's Johnson Space Center Amateur Radio Club in Houston, Texas, from the Goddard Amateur Radio Club in Green Belt, Maryland, from the ARRL SAREX Working Group, and AMSAT, a huge number of school youth can listen to, or even talk to, astronauts orbiting in space.

"The first SAREX shuttle mission in March of this year will feature a highly-inclined orbit, which will allow for excellent opportunities for school youth to make QSOs with the shuttle. The crews of the next two missions, STS-50 and STS-4, will each plan some special educational aspects for their particular missions."

You can easily find ways to integrate SAREX activities into the subject of science—how weather affects launches, orbital mechanics, gravity, and so on. Other subjects require a little bit of thinking. To get started,



6th grader Robert Carter built his own telegraph key for his construction project for SAREX.

here are some examples: writing letters to astronauts—language arts; designing QSL cards—art; studying dimensions of the orbiter—mathematics; looking at the orbiter's flight path—geography; and researching

which countries are working together on Space Station Freedom—social studies. You'll be able to come up with many other ideas for your particular class.

continued on page 26

Backpacker's Special

Portable and lightweight.

by Don Crowder N5TWH

Here's an antenna that's portable, light and highly effective in an emergency where antenna height has everything to do with performance. It can be used for 2 meter or 440, depending on how it's cut. If it's cut for 2 meters, it's dual-band.

I make a lot of my own antennas for VHF (high-band) and UHF so, years ago, I converted the formula to get the length of a quarter wave, in inches, for a given frequency. This formula is: 2808/the frequency (in MHz). Maybe this is one of those formulas that "everybody knows," but I've never seen it in print and had to work it out for myself.

Use the formula to calculate the quarter-wave length for your desired 2 meter or 440 frequency. Let's call this number "L." Grab one end of your 50-foot piece of coax and, being VERY CAREFUL not to nick the shield, cut off a length of the outer insulation "L"-plus-one-inch long.

Now comes the hard part. Carefully and patiently, push the shield back until it rolls over itself and extends down over the outer insulation. Measuring from where you cut away the outer insulation, adjust the shield (it'll extend and collapse easily now) so that the length of the amount

showing is equal to "L." Put a piece of tape on it to hold it in place. Again measuring from where you cut the outer insulation, and without removing the inner insulation, cut the exposed center conductor length to equal "L."

Now we have what is called a "coaxial" antenna. It will work fine as is, but it's not quite finished yet. Now, lay one end of your string along side the shield, extending towards the nearby end of the coax, and either tape it on or put a piece of heat shrink over the whole works. (See Figures 1a and 1b.) Install your connector on the other end of the coax and attach a weight of your choice to the other end of the string.

To use this simple wonder, throw the weight over a nearby tall tree limb or signpost (PLEASE, no power lines) and hoist it up as high as possible. Connect your portable rig and "poof"! Instant performance boost.

Dual-Band

Any odd multiple of quarter-wavelength will match a given frequency. While 2 meter and 440 don't come out quite perfect, an antenna cut for 147 MHz is three-quarter-

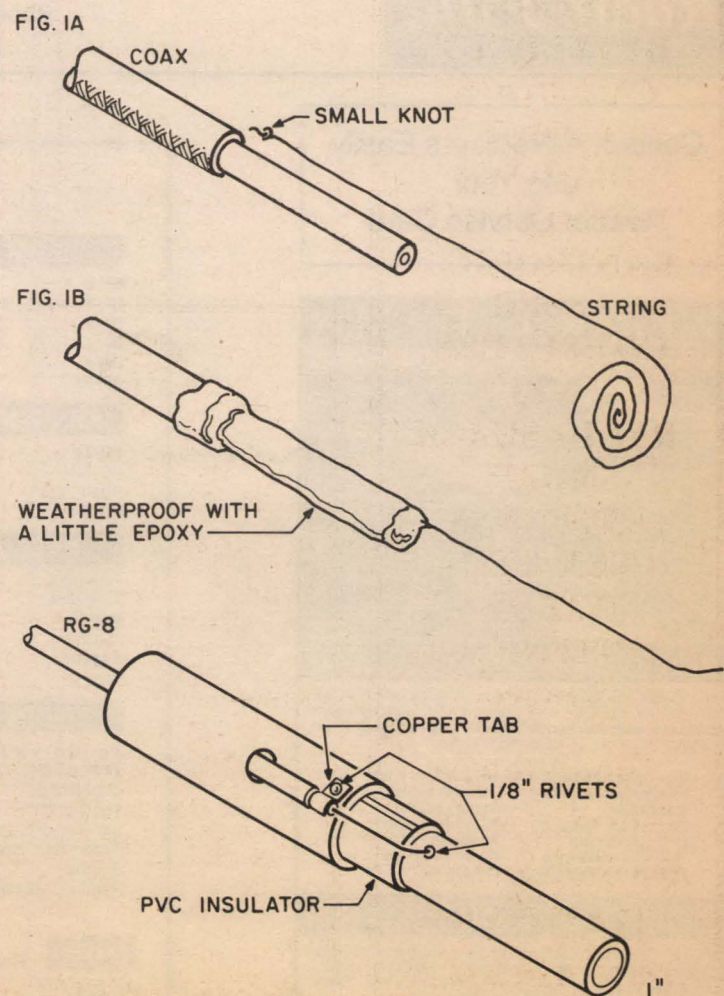
wavelength at 441 MHz and, consequently, while less than unity gain at 441 MHz, will match. An acceptable match from 145 to 149 MHz, and from 439 to 443 MHz, could be obtained. (To improve the bandwidth, you would have to develop a design using larger diameter antenna elements.)

For test purposes, I use a coaxial antenna made from large-diameter aluminum tubing. This antenna, cut for approximately 153 MHz, produces a usable match from 141 MHz to 165 MHz, and from 444 MHz to 474 MHz. These frequencies cover 90% of the equipment I have occasion to test. (The whole thing is inside a 2" PVC radome which has been spray-painted flat black.)

RF

Materials

- 50 feet RG58 (U or A/U — A/U is better).
- 50 to 75 feet light nylon (or other) string.
- Connector to fit your portable, or PL259 and appropriate adapter.
- Electrical tape, or an adequate length of heat-shrink tubing.
- A fairly heavy fishing weight or other sturdy object weighing several ounces.





by Michael Bryce WB8VGE

radio magic

Old, Old Radios

Once in a while, I pick up an antique broadcast radio at a swap meet. Now, I don't make it a hobby of fixing up antique radios, but I do enjoy it now and then. I'll show you how voltage checks alone can fix a lot of radios.

Getting an antique radio (or any other radio, for that matter) operating without a schematic or replacement parts can really get your gray matter working. Case in point is the tabletop radio I picked up for \$15. It had a nice looking case needing few wood working repairs. It covers the AM broadcast band as well as two short-wave bands. Of course, the guy who sold it to me said, "It worked the last time I plugged it in." I wonder what year it was when he last plugged it in? Needless to say, the radio did not play. Even though this broadcast receiver is not a Drake TR4, the techniques used in its repair may be applied to whatever radio you're working on, especially tube-based radios.

Before plugging the set in, I gave it a real good look over. You know—for loose wire, unsoldered connections, loose tubes, and obvious physical damage. Aside from years of dust and dirt, it all looked fine. Because of the age of this set, I replaced all of the paper 0.01 μ F ca-

pacitors I could see. Now you may not have to do this with a ham band receiver unless it, too, is very old. Some of the real early ham receivers also used paper capacitors.

The electrolytic capacitors in the power supply were also replaced. Again, this is common practice when working on an antique radio. The bulge on the right side of the metal capacitor also confirmed the need for replacement. To keep the appearance of the radio original, I keep the old capacitor mounted to the chassis, and solder new caps on the underside of the chassis.

The canned electrolytic capacitor contained three individual capacitors connected to a common ground. It looks like the original, and besides, you'll never be able to get the exact replacement capacitor anyway. If you want to resell the radio, you'll be able to get a premium price if the appearance is original.

When I unsoldered the leads to the electrolytic capacitors in the power supply, I used my digital VOM to check for resistance. Two of the three electrolytic capacitors were shorted out.

With the new caps installed, it was time to fire the beast up. Since many of the older radios don't have line fuses in them (this one was no exception), I have a special outlet on my

work bench which is fused at 4 amps. To keep from buying fuses by the truck load, I use a circuit breaker instead of a fuse. With the radio plugged into my fused outlet, the power is turned on. There is one dial light out. All the tubes light up, but nothing comes from the speaker. No hum, buzzes, snaps or pops emit from the speaker.

Checking the Voltage

Setting the VOM to read voltage, I used the chassis for my ground return and checked for plate voltage on the electrolytic capacitors. Well, the VOM showed hardly any voltage on the capacitors. Working back from the capacitors, you find the rectifier tube, a 5V4. Since I didn't have the schematic, and I can't remember all the tubes and their pinouts, I employed *The ARRL Handbook*.

There is a section on tubes, giving their pinouts and the voltages on each pin. Ideally, a good old RCA receiving tube book would be great. I can't find mine anywhere! As it just so happened, the 5V4 was bad. (Looking back at this, if I had a tube tester, I would have tested the tubes before plugging in the set. But I don't have a tester, so I had to make do with the VOM.)

Not having a 5V4 in the shack, I used a 5U4. It has the same pinouts, but slightly different specifications. Both are full-wave rectifier tubes. Replacing the tube and re-checking for plate voltage revealed that the new tube was working. The shorted electrolytic capacitors in the power supply more than likely caused the 5V4 to die. The plate voltage did seem to be a bit low, only 200 volts

or so on the plate of the 5U4.

With the plate supply operating, I started to look over the underside of the chassis for parts heating up. After a few minutes, I could smell the pungent aroma of hot transformer. Hot is not quite the word. Near meltdown would be closer. A few minutes more, and a small whip of smoke emerged from the speaker (not the chassis).

Why the Speaker Smokes

So what have we got? Low plate voltage and a really hot power transformer, along with a smoking speaker, are the clues to deeper trouble. Do you see now why it is very important to check the power supply voltage?

This old radio was made before PM (permanent magnet) speakers, using what they called an electromagnetic speaker. Instead of a large permanent magnet, the system used a coil of wire. This inductor coil, as part of the power supply, smoothed out the DC from the rectifier tube. It was also known as a smoothing choke.

To fix the smoking speaker, apply simple electrical logic. What happens when you draw too much current? Well, the supply voltage goes down (current goes up, voltage goes down), and the excess current causes the weakest part to overheat. The electromagnet on the back of the speaker smoked because of all the current flowing through the power supply.

Most of these older sets allow you to unplug the speaker from the chassis. I did this, and the plate voltage shot up to 350 volts, and the power transformer no longer got meltdown hot.

What I did next is rather unusual, but it does work. Remember, you're

working on some very high voltages under the chassis of a tube radio. It's not solid-state running on 12 volts.

The Headphone Test

Aside from the plate voltage, there is the line voltage (good ol' 110 AC) running all over the place. Be careful! I took a 0.01 μ F capacitor rated at 600 volts and a pair of 2000 ohm headphones, and coupled some audio from the cathode of the audio power tube. I could hear stations playing in the headphones. If you try this, *don't put the phones on your head!* Lay the phones on the work bench and you'll be able to hear them just fine. They're not loud, but you can tell if there is something coming out of them. This test with the headphones proves the radio is working. So now we know there is something loading down the power supply enough to cause the speaker's electromagnet to get hot, and there is no audio coming from the speaker. A bad speaker, or shorted electromagnet? Or could it be a bad audio tube?

Look at all we have found and fixed on this receiver using nothing but a digital VOM and common sense testing. We had no schematic, but were able to find and repair the power supply. We don't know if the voltages are correct, but they look good. A plate of a tube should be at least a few hundred volts, not 68 volts.

Using these same techniques, you can troubleshoot your own radios to use or collect or perhaps resale for some profit. Next month, we'll finish with the broadcast receiver and get it running, all without expensive test equipment or stacks of manuals and schematics. **RF**

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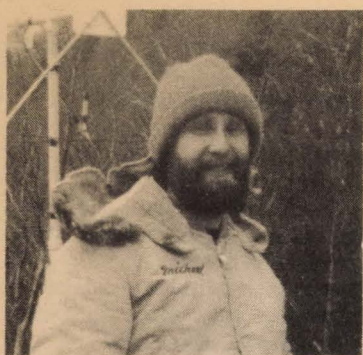
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Kit Building

Before we get to this month's topic, let's finish up the battery discussion.

Let's face it, NiCds (nickel-cadmium) batteries, pronounced "nicads," are serviceable but not great. Their lovely flat discharge curve, which helps extend operating time, also makes it very difficult to measure how much energy is left in a battery pack. After all, it reads about the same voltage whether it's been in use for 20 minutes or is ready to give out in moments. That's why very few walkie makers go to the trouble of putting decent voltage metering on the rigs; it really only works well with alkalines or gel cells, and we use NiCds almost exclusively. Add to this the miserable memory effect, and the fact that most packs don't last more than two or three years, and it is clear that something better would be welcome.

Good news: There's a new technology on the way! It's called "nickel hydride," and it promises to make using our walkies, camcorders, and other toys a lot more fun. Although similar to NiCds, the new batteries are touted to deliver a lot more energy in the same size cells, along with a greatly reduced (but not eliminated) memory effect. The new cells are already available, but not widely, because they currently are too expensive. I suspect we'll start to see them in another year or two. By the way, they also help solve a serious environmental problem by eliminating the toxic cadmium. I, for one, can't wait to get my hands on them!

Putting It All Together

Back when this column began, I suggested that a great way to get involved with the technical side of ham radio was to build a kit. Kit building has been popular nearly as long as radio has been around. Early radio magazines published receiver plans, and many offered kits because parts were hard to find. In later years, buying parts became easy, but these days we've come full circle and components are getting scarce again! So, why not build a kit?

Many experienced home-brewers seem to think that building a kit is so easy and obvious that anyone can

the tech side

by Michael Jay Geier KB1UM

do it with no prior training. Then they wonder why it isn't more popular. Well, if you've ever considered building a kit but felt too intimidated to try it, you're not alone! Fact is, many hams don't know where to begin. So let's take a look at what you need to know to get started having fun.

Choices, Choices

First of all, what do you want to build? Oh, sure, you may want to start off with a 386 computer or an all-band HF rig, but neither of these things would be a good starting point! You've got to consider what it will take to build the thing as well as what you'd like to own when you're done. For starters, pick something simple. A lamp dimmer, an AM radio, something like that. OK, the device may not be thrilling in and of itself, but I guarantee you that you'll feel great the first time you see it work. And you'll sure feel a whole lot better than if you plunk down a fortune and wind up with a paperweight because you did something wrong!

Ready, Aim . . .

Take a look at the catalogs from the various kit makers and pick something reasonable. While you're waiting for it to arrive, get yourself set up to build it. If you don't already have some hand tools and a soldering iron, get them. If you don't know how to solder correctly, now's the time to practice.

Probably the most frustrating thing that can happen with a kit is that a part is missing when you get it or you lose one yourself. You can't help it if they don't send you everything, but you sure can avoid causing your own disaster! Get some paper cups or other kitchen-type containers. Egg cartons are especially nice. You'll use them to separate and hold the various components. If the containers can be written on, great. If not, try to get some sticky paper labels. I know this may sound like overkill for something that has, say, 12 parts, but you're building habits that will save your buns later on when you're whipping up that 2 meter mobile kit or even building something from scratch.

It's Here!

The big day arrives, and with it your new treasure-to-be. Open the box carefully because loose parts may come falling out. If possible, avoid opening it (and building the kit) where there is carpeting; if you drop something, you'll never find it.

Take a good look at the instructions and the number of parts. Is this something you feel you can handle? If you've made your choice carefully, there should be no question about this. Sometimes, though, a kit can look much simpler in the catalog than it turns out to be when you get it. If it looks challenging, fine, go to it. If, however, you feel that it is way above you, consider returning it and selecting something else. Most manufacturers will take kits back as long as you haven't started building them or pulling the parts out of the bags.

A few words about the instructions: Their quality varies greatly from maker to maker. Some kits come with very detailed books that show each part, describe color codes, and even instruct you on the placement of each component, step by step. Heathkit was famous for this kind of wonderful documentation. Alas, they no longer make ham radio kits. Some manufacturers have copied their clear style, while others have developed their own excellent methods. But some kits have very sparse documentation, with perhaps a schematic and nothing else! Such kits can be inaccessible to the beginner, and should be avoided. It pays to read the entire instruction booklet before doing anything else. Also, take a look at the printed circuit board. If it has silk-screened parts labels, great! If not, be sure the instructions include a decent layout diagram.

Before commencing construction, inventory your parts. Never, I repeat never, skip this step, no matter how anxious you are to get started. Sad but true, it is very common for parts to be left out of kits. I remember a calculator watch kit I ordered about 12 years ago that came missing a tiny piece of metal that went into a switch. It took them *one year* to get me that part! Before you panic, please understand that such bad behavior on the part of a kit manufacturer is very rare; most will

replace a missing part very quickly.

When you're sure you have everything, put the parts into the bins and label them. In fact, you can do this as you do the inventory. Naturally, identical parts can be grouped together. Be careful, though, because a 10k ohm 5% resistor is not the same as a 10k ohm 1% resistor, and you could have both in the same kit. If the parts come in separate bags, grouped by type, that makes it easier, of course. In many kits, though, all or most of the parts are just thrown together in one big bag.

Build It!

Open the instructions and get started. If they're Heathkit quality, they will guide you along from the cutting of wire all the way to the finished product. Be sure to check each step off as you go.

If the instructions are more the "here it is, good luck" kind, you have some decisions to make. The obvious one is, "What to do first?" If there are wiring harnesses, it is a good idea to make them up now. If not, the usual first step is to start installing parts on the board.

Always install resistors first. They are the hardest parts, so they are the least likely to get broken during subsequent steps. Although some people prefer to place a bunch of them on the board and then solder them all at the same time, I find it much easier to do each one separately. The other way invariably results in my losing one of the resistors to that great black hole, the floor.

Sometimes the color codes can be hard to read due to variation in the inks used. If you're in any doubt about a part's value, read it with your ohmmeter before installing it. Misinstalled resistors probably are the second most common cause of kit failure (the first is bad solder joints).

Next, put the capacitors in. Like resistors, many caps are insensitive to polarity. But some are marked for + or - and it is vital that you get them right. Nearly all electrolytics (those can-like things) and tantalum caps (the small dipped plastic ones) are sensitive to polarity. The giveaway is a + or - sign, or an arrow. If there's an arrow, the polarity marking should be next to it.

If the kit has any coils or chokes, now's a good time to put them in. The exception is if any of them is fragile. If so, save it for later. If you haven't already done so, install any trimpots (small variable resistors) and trimcaps (small variable capacitors) now.

Always install semiconductors last because they are the easiest damaged, both physically and electrically. If there are any diodes, do them first.

They are always polarity sensitive, with the exception of some varactor tuning diodes, which are actually not diodes but voltage-variable capacitors. The band on a diode is the cathode (negative end), shown on the schematic as the flat side at the tip of the arrow.

Install transistors next. These three-legged beasts come in various packages and some can be confusing. The leads on most small plastic kinds are arranged as emitter, base, collector when viewed from the front, flat side with the leads facing down. Japanese parts, usually labeled 2SA, 2SB, 2SC or 2SD (or sometimes without the 2s before the number, usually use the scheme: emitter, collector, base. Transistors with round cases have a tab or flat corner, which is nearest the pin that is the emitter. The leads are in a triangular formation, with the lead nearest the emitter being the base, and the last one being the collector. Of course, if the documentation shows the transistor orientation, go with that. Sometimes, though, a transistor can be substituted for a different case type with no mention of it in the docs, and you'll have to use your judgement.

Finally, install the ICs. Be sure to get them the right way around. Pin 1 usually has a dot or indentation over it. If not, look for the end of the chip with the notch cut in it. Place it with the legs facing down and the notch to your left. Pin 1 is the leftmost pin facing you. By the way, never use the part number on an IC to determine where pin 1 is; sometimes the numbers are printed upside down.

When handling semiconductors, be sure that you are not charged with static. Especially in winter, consider removing your shoes while you build. (Naturally, put them back on before applying any AC power!) If you can, touch a ground connection with your hand and then with your soldering iron before you solder the pins. Just take care to avoid any situation which could result in a shock. Normally, no power is in use except by the soldering iron, and that should be properly insulated at its handle anyway.

Well, that about does it for assembling your kit's board. Next time, we'll look at finishing it all up. Till then, 73 from KB1UM. **RF**

Contact Michael Geier KB1UM c/o Radio Fun, Forest Rd, Hancock NH 03449.

You can write to any author c/o Radio Fun, Forest Rd., Hancock, NH 03449

what next? continued from page 24

You can write to ask for a set of free lesson plans from the ARRL Educational Activities Department. The set includes information on how to access some of NASA's resources for your class. You can also get order forms for purchasing or borrowing the videotape "Ham Radio in Space," all about SAREX in schools, from the ARRL. If you discover that the kids fall in love with aerospace and amateur radio, you can also ask for a package of materials about what

teachers across the country are doing with amateur radio in schools.

The following is one of the lessons plans I developed with my students in preparation for one of our SAREX experiences. Listen in on the CQ All Schools Net on Tuesdays and Thursdays at 1730 UTC on 28.303 MHz to hear teachers exchanging ideas for many exciting projects, including SAREX.

Lesson Aim: To learn about Spacelab missions.

Motivation: Say to students, "Imagine factory workers reporting to work in space. Does this sound

farfetched? Maybe not."

Background: In November 1983, the space shuttle *Columbia* was launched with Spacelab 1 in its cargo bay. Spacelab was designed as a place where scientists could do experiments in the unique environment of earth orbit. Due to weightlessness conditions in Spacelab, handrails and foot restraints were installed to prevent scientists from "floating away."

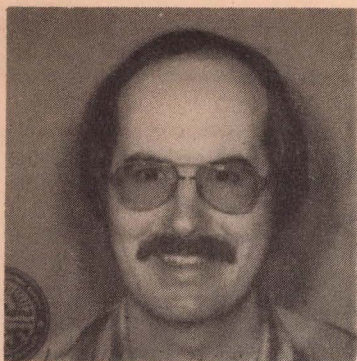
Spacelab has a pallet (storage platform) where materials and equipment can be exposed to space and remotely handled by the shuttle's manipulator arm. The first Spacelab

mission lasted 10 days.

Activities: Science or History: Have committees research the benefits derived from Spacelab missions. These committees could be: Group 1) Animal Research; Group 2) Electronics/Communications; Group 3) Drugs/Medicines. Examples: 1) Manufacture accurately and economically in a space environment; 2) We've learned that conditions in space make drug-manufacturing easier; 3) Electrophoresis is a method studied on the space shuttle in which materials that are dissolved can be separated from one

another by an electrical current; this can be done with a greater degree of purity in space.

Art or Language Arts: Have students submit sketches of what a space "floating factory" might look like, then verbally describe it. Have them write a composition telling what kind of people could work there. Describe what it would be like to live in the Spacelab for several months. One thing workers could do during non-work hours (if they got their amateur radio license before the mission) is talk to family and friends on earth via amateur radio. **RF**



try something new

by Bill Brown WB8ELK

The Challenge of Low Power

If you'd like a real challenge, why not try out the ultimate in QRP (low power) operation? QRP operation is generally considered to be anything below 5 watts. However, a number of QRP enthusiasts try to push the limits and have been quite successful in making contacts using just a few milliwatts (1/1000 of a watt) of power!

The Fireball

A group called the Fireballers can be found on 28.636 or 28.060 MHz. They have a blast making contacts all over the country (and the world) using a miniature transmitter called the Fireball. These little transmitters put out a maximum of 50 milliwatts (0.050 watts). Bob Moody K7IRK, the designer of the Fireball, has even worked all states (WAS) using 2 milliwatts. This record milestone took him a little over a year to achieve.

A complete description of the Fireball transmitter and the sport of milliwatting can be found on pages 12 and 18 of the November 1990 issue of *73 Amateur Radio Today*.

The Joy of QRP

When I first built my Fireball QRP transmitter, I was skeptical that such a little signal could be heard at all. I soon discovered that not only could I make contacts fairly easily, but I quite often received some pretty good signal reports (a couple of them were 579). After a couple of weekends I had QSOs with 17 states (including Hawaii), Norway and Great Britain). Not bad for a transmitter the size of an IC chip. I was definitely hooked on low, low power operation (sometimes referred as QRPp).

A Billion Miles per Watt

Bob K7IRK and I started testing the limits of low power operation. Using the on-board potentiometer on his Fireball transmitter, he could

lower the output power all the way down to 200 microwatts (0.2 milliwatts). I found that if Bob's 100 watt transmitter came in at an S-9 level or better, I could easily hear his 50 milliwatt QRP rig. Depending on the condition of the 10 meter band, I could quite often hear his Fireball rig clear down to its low power limit of 200 microwatts (at times pretty well).

Finally, on one particularly good day, I was hearing Bob's big transmitter coming in with a 40-over-S-9 signal. We decided to go for the ultimate in weak signal contacts. The 50 milliwatt level came in at a whopping S-7 level. He cranked his transmitter all the way down to 200 microwatts and I could still hear it perfectly (although the S-meter wasn't moving at this point). Bob hooked up attenuator pad to the output of his QRP rig and decreased the power even further. He lowered the output as far as he could and sent me a CW message. At first I heard nothing, but with my volume turned all the way up and my CW filter in, I just heard a faint signal. Suddenly, a surge in the band improved the condition just enough for me to clearly copy Bob's message. A minute later the 10 meter band closed down (I could barely hear his 100 watt rig at this point). It was kind of like surfing on a good wave before it crashed on the beach. Bob measured his output power at 0.72 microwatts (720 picowatts). He told me that to lower his power any more he'd have to unhook his battery!

A popular measurement of QRP achievement is to take your transmitter power level and divide it by the number of miles you've covered in your contact. It's 1,536 miles from Bob's home in Palestine, Texas, to my location at the W2NSD/1 ham shack at the *Radio Fun/73 Amateur Radio Today* offices in Hancock, New Hampshire. Our contact worked out to be a record-breaking 2.133 BILLION miles per watt! Curiously enough, we did this at exactly 2133 UTC on 1/19/92. Bill Smith

WA6YPE witnessed this contact from Glendora, California, and was able to copy Bob's transmitter at the 1.56 microwatt level. This contact worked out to be 840 million miles per watt.

The Way to Success

Don't expect to break a major DX pile-up with your QRP transmitter. To make successful contacts, wait until your frequency is clear before you try calling "CQ QRP." It's best to call on one of the QRP calling frequencies for best results (28.060, 21.060, 14.060, 7.030, 7.040 or 3.560 MHz). Also, on 10 meters, try 28.636 and a Novice frequency of 28.322 MHz. Don't get discouraged if no one comes back to you at first. A little persistence and careful study of band conditions will start bringing in the contacts.

Roll Your Own

Some mail-order catalogs offer a number of very inexpensive computer clock oscillator modules. Some of these actually land in the ham bands. The most popular frequencies are 14.318 MHz (not a good choice for QRP) and 28.322 MHz

Continued on page 30

Parts List

- 1 oscillator module (28.322 or 28.060 MHz) (Digi-Key CTX128 or X131)
- 1 14-pin IC socket
- 1 0.01 uF capacitor
- 1 5-volt regulator (optional if using 9-volt battery)
- 2 1.0 uF tantalum capacitors (9-volt option)
- 1 6-volt battery (or 9-volt with regulator)
- 1 prototype board (Radio Shack)
- 1 antenna jack (RCA jack, SO-239 or BNC)
- 1 Morse code key or microswitch
- 1 battery connector or clip leads

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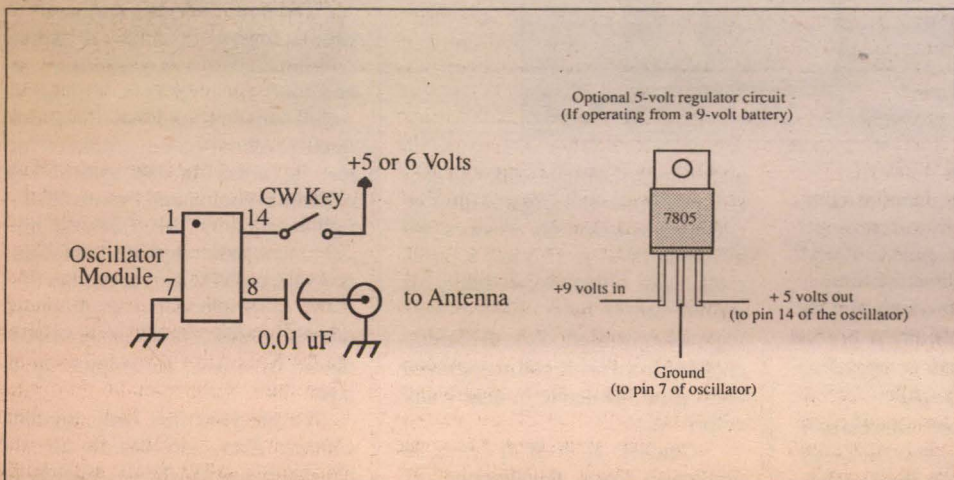


Figure 1. Schematic diagram of the 10 meter micro-QRP transmitter.

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The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 10 cents a word for individual (noncommercial) ads, and 70 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested.

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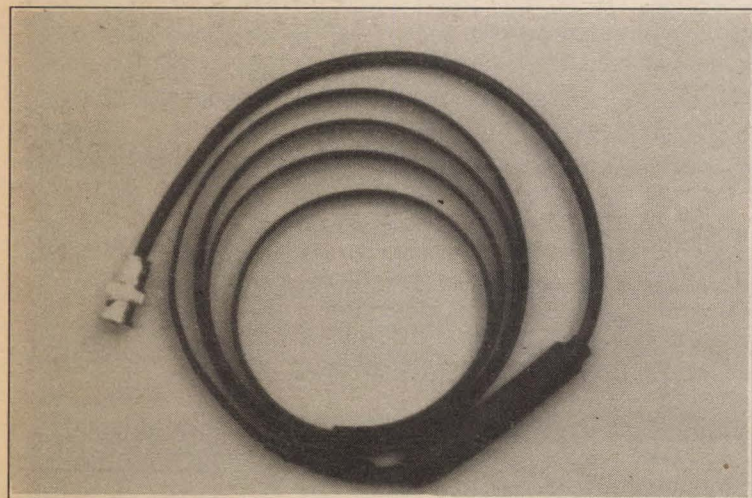
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new products



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The MFJ-1730 retails for \$14.95 and comes with a one-year unconditional guarantee. For more information, contact *MFJ Enterprises, Inc.*, P.O. Box 494, Mississippi State MS 39762; (601) 323-5869, (800) 647-1800, Fax: (601) 323-6551.

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Uncle Wayne's Bookshelf

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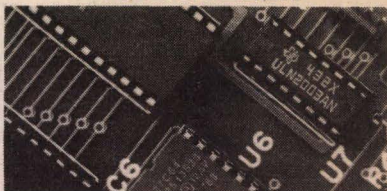
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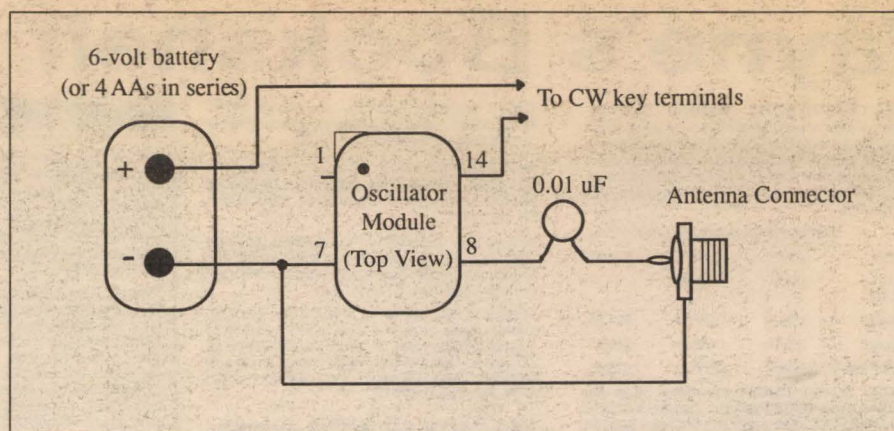
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RF0392

Figure 2. Wiring diagram of the transmitter.



try something new

Continued from page 27

(in the Novice voice band). I've found that the 28.322 MHz frequency works well since you can establish your initial contact on voice with a higher power rig before you fire up the micro-transmitter. It's also become the frequency of choice for a number of high altitude balloon experiments that have been launched from various areas of the country (imagine flying a micro-transmitter to 100,000 feet).

All you need to make your own 10 meter micro-QRP transmitter is a computer clock module on 28.322 MHz, a 6-volt battery, a key and an antenna jack (see Figure 1). You can also power the micro-transmitter from a 9-volt battery if you use a 5-volt voltage regulator (don't operate the oscillator module with more than 6 volts).

Just wire up the circuit (as shown in Figure 2) on a small Radio Shack breadboard, hook up a 10 meter antenna and attach your battery source. You're now ready for the real QRP fun. You will have to wire up an antenna switch to change from your receiver to the micro-transmitter (or just physically move the coax each time).

Computer clock oscillators are available from Digi-Key at (800) 344-4539. Order their CTX128 module on 28.322 MHz for 30 milliwatts of output power, or their X131 module for 8 milliwatts. You can order an oscillator module on a custom frequency from Cal Crystal Lab, Inc., 1142 N. Gilbert, Anaheim CA 92801; (714) 991-1580. A module is also available on the QRP frequency of 28.060 MHz (or 28.322) from Smith Enterprises (address below) as part of a complete kit.

If you'd like a full-fledged kit with a high quality PC board that includes an antenna relay and a power adjust control, you might consider getting a Fireball transmitter from Smith Enterprises, 408 E. Mauna Loa, Glendora CA 91470; (818) 963-0079. For \$26 you not only get the transmitter, but receive an official Fireball number and certificate with your transmitter. They also have an LED power indicator available that will tell you when you are at the 10 milliwatt level.

I hope you give QRP operating a try. You definitely don't need a thousand watts to communicate, and you'll have a lot of fun making contacts with a transmitter that fits in the palm of your hand. **RF**

A complete kit including an antenna relay, PC board and power adjust control is available from Smith Enterprises, 408 E. Mauna Loa, Glendora CA 91470 for \$24 + \$2 shipping (CA residents add sales tax). Telephone: (818) 963-0079. Be sure to specify your choice of frequency (28.060 or 28.322 MHz).

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The competition is still working on a radio that's as powerful and easy to use as the FT-415/815 handhelds. But why wait? Visit your Yaesu dealer today and leap ahead of the competition.

FT-415/815

2M/UHF Handheld Transceivers

FT-415: 130-174 MHz Rx 140-150 MHz Tx

FT-815: 430-450 MHz Rx/Tx

41 Memories (All memories store separate transmit and receive frequencies for "odd splits")

2 VFOS

① DTMF Calling and paging built-in
Built-in VOX

② Back-lit Keypad and Display (with time delay)

③ DC Direct Operation (Automatically Charges Battery with 12 Volts, FNB-25 only)

④ Four Power Levels (With FNB-27 Battery)

Direct Keyboard Entry for All Functions
Programmable and Automatic Battery Saver (ABS)

⑤ CTCSS Encode/Decode Built-In
5 Watts Output With FNB-27 or DC Direct

⑥ Rugged Case Construction

Automatic Power-Off (APO) Turns Radio Off Automatically After 30 Minutes

DTMF 10 Memory Autodialer, Built-In

Selectable Frequency Steps (5, 10, 12.5, 15, 20 or 25 KHz)

Four Ways to Scan (Band Scan, Memory Scan, Memory Skip, Programmable Scan)

Optional Accessories:

NC-42 1-Hour SMART Desk Charger

E-DC-5 DC Adapter With Noise Filter

MMB-49 Mobile Mounting Bracket

YH-2 Headset for VOX Operation

FBA-12 AA 6-Cell Holder

Some accessories and options are standard in certain areas. Check with your Yaesu Dealer for details.

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Band Stacking Register enables you to store frequency and mode for automatic return.

Ultra Quiet Operation. The IC-725's super-sensitive low noise receiver, with ICOM's Direct Feed Mixer (DFM) provides clear, fatigue free reception. It's specially designed cooling system with quiet fan reduces operational noise to a whisper.

ICOM's **DDS** (Direct Digital Synthesizer) generates ultra-clean waveforms, resulting in clear crisp reception and low distortion transmission.

Durable ICOM Construction means higher performance and reliability for years to come (i.e. sturdy aluminum die-cast frame and integral, efficient heat sink).

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IC-725 HF Transceiver, PS-55 AC Power Supply, IC-2KL 500 watt fully solid state Linear Amplifier, IC-475 UHF Transceiver, IC-275 VHF Transceiver. All units can be computer controlled.

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